Chapter 5
Conservation Plan

5.1 Introduction

This chapter presents the LCR MSCP Conservation Plan. The Conservation Plan is a comprehensive plan to conserve, monitor, and manage populations and habitat of covered species. The Conservation Plan is designed to address and meet the overall goals of the LCR MSCP (Section 1.2, "LCR MSCP Goal"). The Conservation Plan provides conservation measures for covered species that address the effects of all non-Federal covered activities described in Chapter 2 of this HCP and all Federal covered activities described in the companion LCR MSCP BA.

The LCR MSCP has adopted a habitat-based approach to the conservation of covered species. The LCR MSCP established conservation goals to avoid, minimize, and fully mitigate impacts on all covered species and their habitat; contribute to the recovery of listed covered species; and reduce the likelihood for future listing of nonlisted covered species.

Conservation measures are specific actions designed to achieve goals for covered species and research objectives for evaluation species. Most conservation measures are directed toward creation of species habitat, maintenance of existing species habitat, and augmentation of species populations. In some instances, additional species-specific conservation measures are required elements of the LCR MSCP to ensure achievement of the LCR MSCP goals. The conservation plan is based on the best scientific information available. Sources that were used to develop conservation measures included:

- *Final Southwestern Willow Flycatcher Recovery Plan* (U.S. Fish and Wildlife Service 2002b),
- *Yuma Clapper Rail Recovery Plan* (U.S. Fish and Wildlife Service 1983),
- *Bonytail* (Gila elegans) *Recovery Goals: Amendment and Supplement to the Bonytail Recovery Plan* (U.S. Fish and Wildlife Service 2002c),
- *Razorback Sucker* (Xyrauchen texanus) *Recovery Goals: Amendment and Supplement to the Razorback Sucker Recovery Plan* (U.S. Fish and Wildlife Service 2002e),
- *Humpback Chub* (Gila cypha) *Recovery Goals: Amendment and Supplement to the Humpback Chub Recovery Plan* (U.S. Fish and Wildlife Service 2002d).

- conservation recommendations presented in BOs (U.S. Fish and Wildlife Service 1997, 2001),
- state and Federal resource planning documents,
- scientific literature, and
- input from resource specialists.

In accordance with the LCR MSCP adaptive management process (Section 5.12), as new information is learned through monitoring and research (Section 5.11) conducted under the LCR MSCP or by others, conservation measures may be modified or new conservation measures developed to better ensure the efficient and timely achievement of goals for covered species.

5.2 Approach to Developing Conservation and Biological Goals

5.2.1 Conservation Goals

Three conservation goals were used to guide the LCR MSCP Conservation Plan. These goals are consistent with the overall LCR MSCP goals (Chapter 1). Conservation goals for each covered species are presented in Table 5-1. One or more of the following conservation goals applies to each species.

- **Avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the species.** This goal applies to all covered species that could be adversely affected by covered activities or LCR MSCP implementation. This goal is consistent with the ESA section 10 incidental take regulations, which require that the Conservation Plan, to the maximum extent practicable, minimize and mitigate the impacts of the covered activities on covered species (50 C.F.R. §17.22(b)(2)(B)).
- **Contribute to recovery of listed species.** This goal applies to Federally listed species:
  - that depend on the aquatic, wetland, or riparian environments present in the LCR MSCP planning area and
  - for which implementation of the LCR MSCP is reasonably certain to measurably benefit the species.
- **Reduce the likelihood of future Federal listing of nonlisted species.** This goal applies to species that are not currently listed under the ESA:
  - that depend on the aquatic, wetland, or riparian environments present in the LCR MSCP planning area and
  - for which implementation of the LCR MSCP is reasonably certain to measurably benefit the species.

Table 5-1. LCR MSCP Conservation and Biological Goals for Covered Species

Covered Species	Conservation Goals			Biological Goal
	Avoid, Minimize, and Fully Mitigate Adverse Effects of Covered Activities and LCR MSCP Implementation on Species[a]	Contribute to Recovery of Listed Species[b]	Reduce the Likelihood of Future Federal Listing of Nonlisted Species[b]	
Yuma clapper rail	X	X		Create and maintain 512 acres of species habitat.
Southwestern willow flycatcher	X	X		Create and maintain 4,050 acres of species habitat.
Desert tortoise (Mojave population)	X			Protect 230 acres of unprotected occupied species habitat.
Bonytail	X	X		Create and maintain 360 acres of species habitat and rear and release up to 620,000 juvenile bonytail along the LCR over the term of the LCR MSCP.
Humpback chub	X	X		Provide $500,000 in funding to support existing species conservation programs.
Razorback sucker	X	X		Create and maintain 360 acres of species habitat and rear and release up to 620,000 juvenile razorback sucker along the LCR over the term of the LCR MSCP.
Western red bat	X			Create and maintain 765 acres of species roosting habitat.
Western yellow bat	X			Create and maintain 765 acres of species roosting habitat.
Desert pocket mouse	X			Fully restore occupied habitat that is disturbed as a result of implementing covered activities that create, restore, or maintain habitat.
Colorado River cotton rat	X			Create and maintain 125 acres of species habitat in Reaches 3 and 4.
Yuma hispid cotton rat	X			Create and maintain 76 acres of species habitat in Reaches 6 and 7.
Western least bittern	X		X	Create and maintain 512 acres of species habitat.
California black rail	X		X	Create and maintain 130 acres of species habitat.
Yellow-billed cuckoo	X		X	Create and maintain 4,050 acres of species habitat.

Covered Species	Conservation Goals: Avoid, Minimize, and Fully Mitigate Adverse Effects of Covered Activities and LCR MSCP Implementation on Species[a]	Conservation Goals: Contribute to Recovery of Listed Species[b]	Conservation Goals: Reduce the Likelihood of Future Federal Listing of Nonlisted Species[b]	Biological Goal
Elf owl	X		X	Create and maintain 1,784 acres of species habitat in Reaches 3–5.
Gilded flicker	X		X	Create and maintain 4,050 acres of species habitat in Reaches 3–7.
Gila woodpecker	X		X	Create and maintain 1,702 acres of species habitat in Reaches 3–6.
Vermilion flycatcher	X		X	Create and maintain 5,208 acres of species habitat.
Arizona Bell's vireo	X			Create and maintain 2,983 acres of species habitat.
Sonoran yellow warbler	X		X	Create and maintain 4,050 acres of species habitat.
Summer tanager	X		X	Create and maintain 602 acres of species habitat.
Flat-tailed horned lizard	X			Protect 230 acres of unprotected occupied species habitat.
Relict leopard frog	X		X	Provide $100,000 in funding to support existing species conservation programs.
Flannelmouth sucker	X		X	Create and maintain 85 acres of species habitat in Reach 3 and provide $400,000 in funding to support existing species conservation programs.
MacNeill's sootywing skipper	X			Create and maintain 222 acres of species habitat in Reaches 1–4.
Sticky buckwheat	X		X	Provide $10,000 per year until 2030 to support sticky buckwheat and threecorner milkvetch conservation programs.
Threecorner milkvetch	X		X	Provide $10,000 per year until 2030 to support threecorner milkvetch and sticky buckwheat conservation programs.

Notes:

[a] This goal applies to all species that could be adversely affected by covered activities or LCR MSCP implementation.

[b] This goal applies to species that depend on the aquatic, wetland, or riparian environments present in the LCR MSCP planning area, and for which implementation of the LCR MSCP is reasonably certain to measurably benefit the species.

For the first goal listed above, the LCR MSCP participants will undertake actions within their legal authority and jurisdiction to avoid or minimize habitat loss and will replace lost habitat for covered species that depend on the aquatic, wetland, and riparian environments present in the LCR MSCP planning area. Conservation measures in the LCR MSCP Conservation Plan are designed to contribute to the recovery of five listed species and to reduce the likelihood for the future listing of 13 species. The LCR MSCP also addresses nine covered species for which the only goal is to avoid, minimize, and fully mitigate the effects of covered activities. The LCR MSCP Conservation Plan does not include conservation measures to contribute to the recovery of or help reduce the likelihood for future listing of nine of the covered species for the following reasons:

- the species is not associated with the aquatic, wetland, or riparian land cover types that are the focus of the LCR MSCP (i.e., desert tortoise, flat-tailed horned lizard);
- the ecology of the species, factors that are limiting to the species, and/or the species' microhabitat requirements are not sufficiently understood to provide a reasonable expectation that conservation measures can be developed that will reduce the likelihood for future listing of the species (i.e., western red bat, western yellow bat, desert pocket mouse, Colorado River cotton rat, Yuma hispid cotton rat, and MacNeill's sootywing skipper);
- the extent of cottonwood-willow structural types created to provide habitat for the species is limited, and increasing the extent of creation of these cottonwood-willow structural types would reduce the extent of creation of cottonwood-willow structural types necessary to benefit other covered species (i.e., Arizona Bell's vireo).

5.2.2 Biological Goals

Under its Five-Point Policy, USFWS recommends that the HCP identify biological goals and specifically states that "…the Services and HCP Applicants will clearly and consistently define the expected outcome, i.e., biological goal(s)." (65 FR 106:35256, June 1, 2000). Goals and conservation measures for LCR MSCP covered species are presented in this chapter. These goals are consistent with the overall LCR MSCP goals (Chapter 1) and the conservation goals (Section 5.2.1). The biological goals for covered species are presented in Table 5-1. Species biological goals are quantitative, measurable, and are based primarily on the creation of new species habitat and augmentation of populations.

The LCR MSCP has not established goals for the conservation of evaluation species. The LCR MSCP, however, identifies research that will be undertaken to determine the status, conservation needs, and feasibility of implementing conservation measures that would benefit evaluation species. LCR MSCP goals will be developed for the evaluation species if they are proposed for coverage under the LCR MSCP in future years.

5.2.3 Noncovered Species Benefits

Creation of 5,940 acres of cottonwood-willow and 1,320 acres of honey mesquite land cover under the LCR MSCP is expected to benefit many other riparian-associated bird

species that are not covered under the LCR MSCP. Table 5-2 lists some of the bird species that breed or migrate through the LCR MSCP planning area that are expected to substantially benefit from the creation of covered species habitats.

Implementation of the LCR MSCP Conservation Plan is expected to improve the function of the LCR as stopover habitat for neotropical migrant birds during critical periods of migration movements and provide essential resting and foraging habitat for these riparian-associated species during migration. The LCR is one of four primary avian migration corridors near the U.S.–Mexico border for neotropical birds that annually migrate from wintering habitats in Mexico and South America to breeding habitats in the United States and Canada. Most migrant birds must stop periodically to rest and consume food and water. Desert riparian habitats, such as the LCR, provide essential stopover sites for a high diversity of neotropical migrant birds, such as flycatchers, vireos, warblers, tanagers, and grosbeaks. Because of its strategic location in an otherwise arid landscape, the LCR is especially important to a diversity of migrant bird species that breed in the western United States (Rosenberg et al. 1991; Riparian Habitat Joint Venture 2000). For example, of the 12 wood warbler species on the USFWS Partners in Flight Watch List, nine species annually migrate through the LCR (U.S. Fish and Wildlife Service 1999).

Maintaining critical stopover habitats has become recognized as an integral component in the conservation of neotropical tropical migrant birds species (Yong and Finch 2002). Within the LCR MSCP planning area, most of the native riparian vegetation that historically supported stopover habitat has been lost, and the remnant habitat is highly fragmented. The creation of 7,260 acres of new cottonwood-willow- and honey mesquite–dominated land cover under the LCR MSCP is expected to provide substantial benefits to these species, substantially improving the existing condition of riparian sites along the LCR that are currently dominated by nonnative, invasive species, such as saltcedar (*Tamarix* spp.).

In addition to providing habitat for the covered species and neotropical migrant birds, establishment of cottonwood-willow, honey mesquite, marsh, and backwater land cover types will also create native habitats for many other species of wildlife that inhabit the LCR. Patches of created cottonwood-willow and honey mesquite land cover will provide:

- habitat for several species of mammals, including rodents (which are prey for snakes, raptors, and mammalian predators), desert mule deer, desert cottontail, and ringtail;
- foraging and nesting habitat for many native birds, including game birds (e.g., mourning dove and Gambel's quail) and raptors (e.g., Cooper's hawk, American kestrel, and red-tailed hawk); and
- habitat for native reptiles, such as the tree lizard, gopher snake, common kingsnake, and western ground snake.

Creation of 872 acres of marsh and backwater land cover types will provide habitat for many species of resident and migrant shorebirds (e.g., American avocet, western plover), wading birds (e.g., great blue heron, great egret), waterfowl, and other water birds.

Table 5-2. Sensitive Noncovered Bird Species that Are Expected to Benefit from Implementation of the LCR MSCP Conservation Plan

Species	Likely to Benefit Breeding	Likely to Benefit Migrants
Abert's towhee *Pipilo aberti*	X	
Ash-throated flycatcher *Myiarchus cinerascens*	X	X
American bittern *Botaurus lentiginosus*		X
American kestrel *Falco sparverius*	X	
Blue grosbeak *Guiraca caerulea*	X	X
Brown-crested flycatcher *Myiarchus tyrannulus*	X	X
Bullock's oriole *Icterus bullockii*	X	X
Common nighthawk *Chordeiles minor*		X
Common yellowthroat *Geothrypis trichas*		X
Cooper's hawk *Accipiter cooperii*	X	
Greater roadrunner *Geococcyx californianus*	X	
Great horned owl *Bubo virginianus*	X	
Lesser nighthawk *Chordeiles acutpennis*	X	
Long-eared owl *Asio otus*	X	
Lucy's warbler *Vermivora luciae*	X	X
Phainopepla *Phainopepla nitens*	X	X
Yellow-breasted chat *Icteria virens*	X	X

5.3 Approach to Conservation

5.3.1 Conservation Measures

The LCR MSCP includes the following types of conservation measures that, in combination, achieve the conservation and biological goals for regulatory compliance and contributing to species recovery stated in Section 5.2:

- maintenance of an important portion of existing habitat for covered species in the LCR MSCP planning area,
- creation of habitat to establish new habitat, including long-term management of created habitat to maintain and preserve ecological functions,
- avoidance and minimization of impacts on covered species and their habitat resulting from covered activities and LCR MSCP implementation,
- population enhancement measures that directly or indirectly increase abundance of covered species, and
- monitoring and research necessary to assess and improve conservation measure effectiveness and adaptively manage implementation of the LCR MSCP Conservation Plan over time.

The LCR MSCP Conservation Plan is designed to fully mitigate adverse effects on all covered species resulting from covered activities described in Chapter 2 and to meet the ESA section 10 standard to minimize and mitigate the impacts of the covered activities on covered species to the maximum extent practicable (50 C.F.R. §17.22(b)(2)(B)) (Section 5.9).

5.3.2 Science Strategy

The LCR MSCP is a multifaceted, long-range program to conserve covered species that depend on the aquatic, wetland, and riparian environments present in the LCR floodplain. In general, these species are rare, their habits and habitats are not well known, and experience in development and creation of their habitats and management of their populations is limited. The LCR MSCP has used the best available scientific information to develop the LCR MSCP Conservation Plan and will use sound scientific principles and standards to implement the conservation measures.

The LCR MSCP has a commitment to use scientific information, methods, principles, and standards to implement the LCR MSCP Conservation Plan throughout the term of the LCR MSCP. This science-based strategy for implementing the LCR MSCP primarily applies to four major elements of the LCR MSCP Conservation Plan: fish augmentation, habitat creation, monitoring and research, and adaptive management. The LCR MSCP planning processes for implementing conservation measures will incorporate both internal and external science review.

Internal reviews will focus on cost effectiveness of techniques for implementing conservation measures, chronology of implementation, and interrelationships of LCR MSCP Conservation Plan components. Internal reviews will consider:

- the current knowledge of the ecology and life requirements of covered species,
- knowledge gained through applied research undertaken by the LCR MSCP and others, and
- the effectiveness of conservation measures and the status of the species and their habitats, including the results and progress of concurrent research, conservation, restoration, and recovery programs for LCR MSCP covered species undertaken elsewhere in the Colorado River Basin.

External reviews will be conducted by recognized experts in the field of study or program under review. The need for and timing of external review of specific elements of the LCR MSCP will be determined by the Program Manager, and the number of reviewers required will be determined by the complexity of the LCR MSCP element under review.

Baseline conditions will be assessed before implementing conservation measures that create covered species habitats, augment populations, or other species-specific conservation measures (e.g., control brown-headed cowbirds to reduce the incidence of nest parasitism). This assessment of baseline conditions will provide the basis for assessing the success of conservation measures. Methods to implement conservation measures will be developed based on the best available scientific information, the efficacy of the methods will be monitored during implementation, and the effectiveness of the conservation measures will be monitored following implementation (Section 5.11, "Monitoring and Research"). Ineffective measures will be evaluated and, if feasible, modified to improve their effectiveness. Where conservation measures cannot be effectively modified, replacement conservation measures will be developed and implemented.

5.4 Conservation Concepts

5.4.1 Introduction

This section describes the conservation concepts for achieving goals for covered species. These concepts include:

- maintaining important existing habitat areas,
- creating and maintaining new habitat for covered species,
- augmenting populations of covered fish species,
- supporting other programs to implement conservation measures to benefit covered species, and
- timing of implementing conservation measures.

Implementation of the conservation concepts described in this section will serve to mitigate effects of covered activities and LCR MSCP implementation on covered species and to contribute to the recovery of some species. The conservation concepts described in this section and the conservation measures described in Section 5.6, "General Species Conservation Measures," Section 5.7, "Species-Specific Conservation Measures," and Section 5.8, "Evaluation Species Conservation Measures," will be implemented by the Program Manager. A full description of the responsibilities of the Program Manager is presented in Chapter 6, "Governance and Implementation Structure."

5.4.2 Maintenance of Existing Habitat

The existing distribution and abundance of many of the covered species in the LCR MSCP planning area depend on the extent, distribution, and quality of existing habitat, much of which is under Federal and state management. Consequently, to ensure the continued existence of covered species in the LCR MSCP planning area and to allow for future increases in their abundance, it is important that existing habitat areas are maintained by implementing actions that will prevent the future degradation or loss of habitat.

The LCR MSCP will contribute to maintaining the condition of a portion of important existing habitat for southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and California black rail within the LCR MSCP planning area. Maintaining important existing habitat areas is necessary to help ensure the continued existence of these species in the LCR MSCP planning area. Maintaining existing habitat will also help ensure the continued existence of source populations from which individuals will be available to colonize LCR MSCP–created habitats as they develop. Maintenance of important existing habitat areas is part of the strategy to mitigate adverse effects of ongoing and future covered activities and to contribute to the recovery of these species. In addition, the existing habitat that is maintained under the LCR MSCP will provide significant benefits to other covered species that use riparian and marsh habitats. The key elements of the LCR MSCP approach to maintain existing important habitat areas are described below.

- The LCR MSCP will establish a $25 million fund contribution early in the term of the LCR MSCP in an interest-bearing account to be expended on assessing and implementing projects for maintaining existing habitat.
- Habitat maintenance activities could occur anywhere within the LCR MSCP planning area and may be implemented through funding projects by any appropriate agency in the LCR MSCP planning area.
- Habitat maintenance activities will be developed and implemented in cooperation with the managing agency for the property on which the activity will occur.
- Selection of habitat maintenance activities funded by the LCR MSCP will be determined based on a set of detailed criteria to be developed by the LCR MSCP in conjunction with the USFWS. Criteria will be designed to ensure the activities are consistent with the goal of habitat maintenance, goals for covered species, and overall goals of the LCR MSCP.

Table 5-3. Minimum Requirements for Achieving Covered Species Habitat Creation Goals

Species	Habitat Creation Goal (acres)	Created Land Cover Type that will Provide Species Habitat	Minimum Patch Size of Created Land Cover that will Provide Habitat (acres)[a]
Threatened and Endangered Species			
Yuma clapper rail	512	Marsh with water depths no greater than 12 inches	5[b]
Southwestern willow flycatcher	4,050	Cottonwood-willow types I–IV with moist surface soil conditions during the breeding season	10[c]
Desert tortoise	0	Not applicable	Not applicable
Bonytail	360	Backwaters that contain the physical, chemical, and biological conditions required to support native LCR fishes in a healthy condition	Not applicable
Humpback chub	0	Not applicable	Not applicable
Razorback sucker	360	Backwaters that contain the physical, chemical, and biological conditions required to support native LCR fishes in a healthy condition	Not applicable
Other Covered Species			
Western red bat (roosting habitat)	765	Combination of cottonwood-willow types I and II and honey mesquite type III	No minimum requirement[d]
Western yellow bat (roosting habitat)	765	Combination of cottonwood-willow types I and II and honey mesquite type III	No minimum requirement[d]
Desert pocket mouse	0	Not applicable	Not applicable
Colorado River cotton rat	125	Marsh	No minimum requirement[d]
Yuma hispid cotton rat	76	Cottonwood-willow with a moist herbaceous understory	No minimum requirement[d]
Western least bittern	512	Marsh with water depths no greater than 12 inches	No minimum requirement[d]
California black rail	130	Marsh with water depths no greater than 1 inch	5[e]
Yellow-billed cuckoo	4,050	Cottonwood-willow types I–III	25[f]
Elf owl	1,784	Combination of cottonwood-willow types I and II and honey mesquite type III	No minimum requirement[d]

Species	Habitat Creation Goal (acres)	Created Land Cover Type that will Provide Species Habitat	Minimum Patch Size of Created Land Cover that will Provide Habitat (acres)[a]
Gilded flicker	4,050	Cottonwood-willow types I–III	No minimum requirement[d]
Gila woodpecker	1,702	Cottonwood-willow types I–IV	50[g]
Vermilion flycatcher	5,208	Combination of cottonwood-willow types I–IV and honey mesquite type III	No minimum requirement[d]
Arizona Bell's vireo	2,983	Combination of cottonwood-willow types III and IV and honey mesquite type III	No minimum requirement[d]
Sonoran yellow warbler	4,050	Cottonwood-willow types I–IV	2.5[h]
Summer tanager	602	Cottonwood-willow types I and II	No minimum requirement[d]
Flat-tailed horned lizard	0	Not applicable	Not applicable
Relict leopard frog	0	Not applicable	Not applicable
Flannelmouth sucker	85	Backwaters that contain the physical, chemical, and biological conditions required to support native LCR fishes in a healthy condition	Not applicable
MacNeill's sootywing skipper	222	Honey mesquite type III created with quail bush to create honey mesquite–quail bush	No minimum requirement
Sticky buckwheat	0	Not applicable	Not applicable
Threecorner milkvetch	0	Not applicable	Not applicable

Note: Failure to achieve the minimum habitat creation requirements for each species could require implementation of remedial measures (see Section 5.12.3).

Not applicable = Habitat will not be created for this species under the LCR MSCP Conservation Plan and minimum habitat patch size requirements do not apply, or, if habitat will be created for the species, patch size is not a constituent element of the species habitat.

[a] Minimum extent of habitat patches that must be created to be considered species habitat. It is the intent, however, of the LCR MSCP to create habitat in the largest patch sizes possible within the site specific constraints that are associated with conservation areas.

[b] Minimum habitat patch size is based on research indicating that the density of Yuma clapper rail is independent of habitat patch size (Anderson and Ohmart 1985) and the subspecies will use relatively small patches of habitat. Habitat will be created in patches as large as possible but will not be created in patches smaller than 5 acres. Smaller patches are likely to support isolated nesting pairs and be within the range of habitat patch sizes used by the species for foraging and dispersal. Larger patches would be expected to support multiple nesting pairs.

[c] Minimum habitat patch size can vary widely (Sogge et al. 1997a; Spencer et al. 1996; Paradzick et al. 2000; McKernan 1997; U.S. Fish and Wildlife Service 2001). Saltcedar-dominated riparian vegetation at southwestern willow flycatcher breeding sites in the Grand Canyon ranged from 1.48 to 2.22 acres (Sogge et al. 1997a). The minimum habitat patch size was selected based on the assumption that up to a

total of 10 acres of habitat may be required to sustain a nesting pair, accounting for variances in habitat quality among sites and years and periodic loss of habitat to wildfire and other unforeseeable factors.

[d] Minimum habitat patch size requirements for this species is not known or is not well understood. To meet the minimum patch requirements for species for which minimum habitat patch size requirements are established, however, created cottonwood-willow and marsh land cover types will be created, at a minimum, in the following patch sizes:

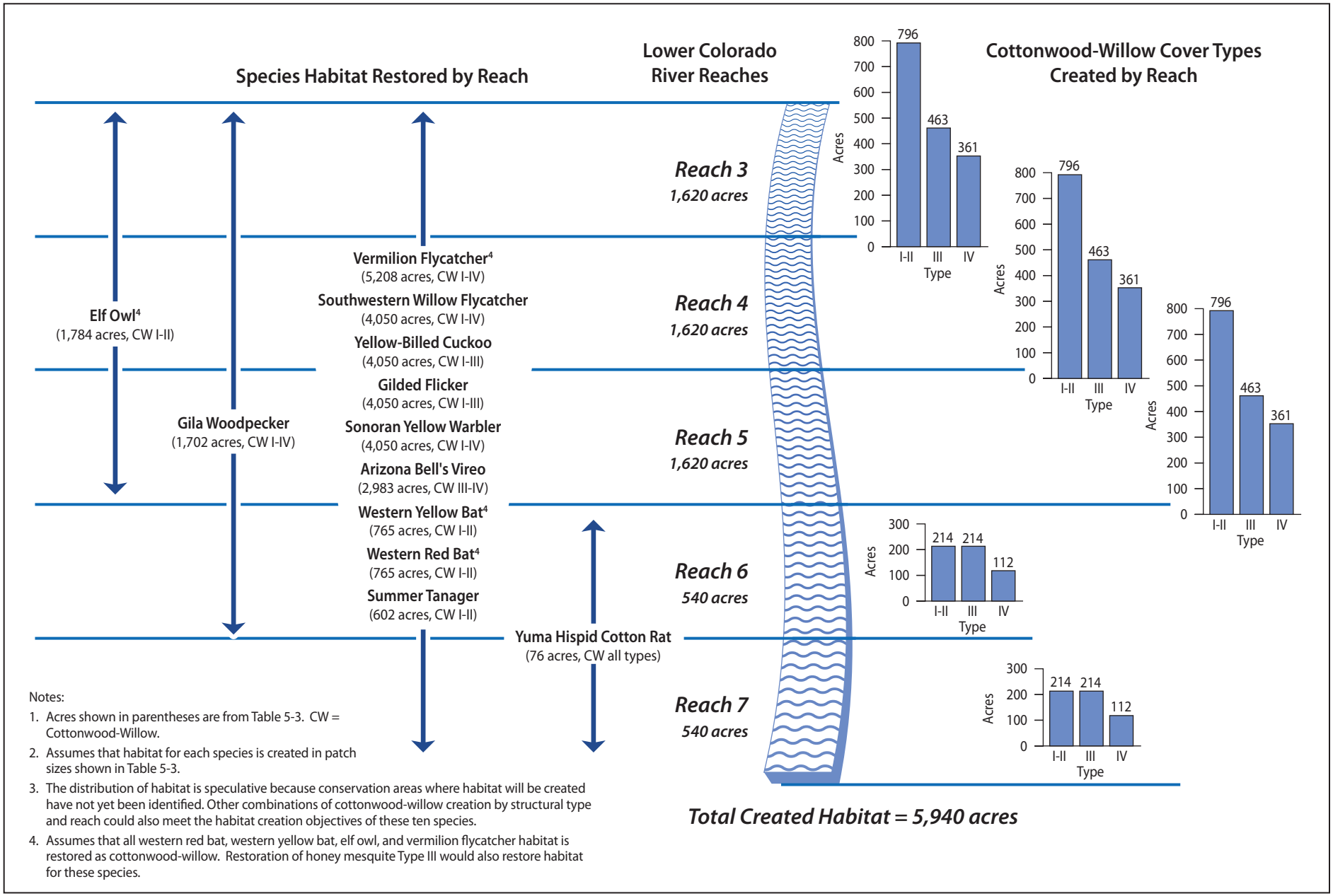
Land Cover Type	Total Extent of Land Cover Type to Be Created (acres)	Minimum Extent to Be Created by Patch Size (acres)			
		50-acre patches	25-acre patches	10-acre patches	5-acre patches
Cottonwood-willow	5,940	1,702	2,348	1,890	0
Marsh	512	0	0	0	512

[e] The minimum patch size requirements for the California black rail in the LCR MSCP planning area is not known. Tecklin (1999), however, found that in the foothills of the central Sierra Nevada the species used marshes as small as 0.5 acre and 32% of occupied wetlands were less than 0.75 acre. Habitat will be created in patches as large as possible but will not be created in patches smaller than 5 acres. Smaller patches are likely to support one to several nesting pairs and be within the range of habitat patch sizes used by the species for foraging and dispersal. Larger patches would be expected to support multiple nesting pairs.

[f] Recent research along the LCR has found that the minimum nesting habitat patch size provided by cottonwood-willow forest for the yellow-billed cuckoo was 25 acres (Halterman pers. comm.). Habitat will be created in patches as large as possible but will not be created in patches smaller than 25 acres, which at a minimum, is expected to provide suitable nesting habitat for 1–2 pairs. Creation of larger patches are expected to provide sufficient habitat to support multiple nesting pairs.

[g] Gila woodpeckers appear to need large blocks of woody riparian vegetation for nesting; isolated patches of woody riparian vegetation less than 49 acres do not support this species (Rosenberg et al. 1991).

[h] Grinnell (1914) reported observing from one to four Sonoran yellow warbler singing males per 2.5 acres in cottonwood-willow stands along the LCR. The smallest patches of cottonwood-willow land cover that will be created are 10 acres (to meet the minimum patch size requirement for the southwestern willow flycatcher) and, therefore, are expected to support several nesting pairs, with larger patches providing the capacity to support larger numbers of nesting pairs.



Notes:

1. Acres shown in parentheses are from Table 5-3. CW = Cottonwood-Willow.
2. Assumes that habitat for each species is created in patch sizes shown in Table 5-3.
3. The distribution of habitat is speculative because conservation areas where habitat will be created have not yet been identified. Other combinations of cottonwood-willow creation by structural type and reach could also meet the habitat creation objectives of these ten species.
4. Assumes that all western red bat, western yellow bat, elf owl, and vermilion flycatcher habitat is restored as cottonwood-willow. Restoration of honey mesquite Type III would also restore habitat for these species.

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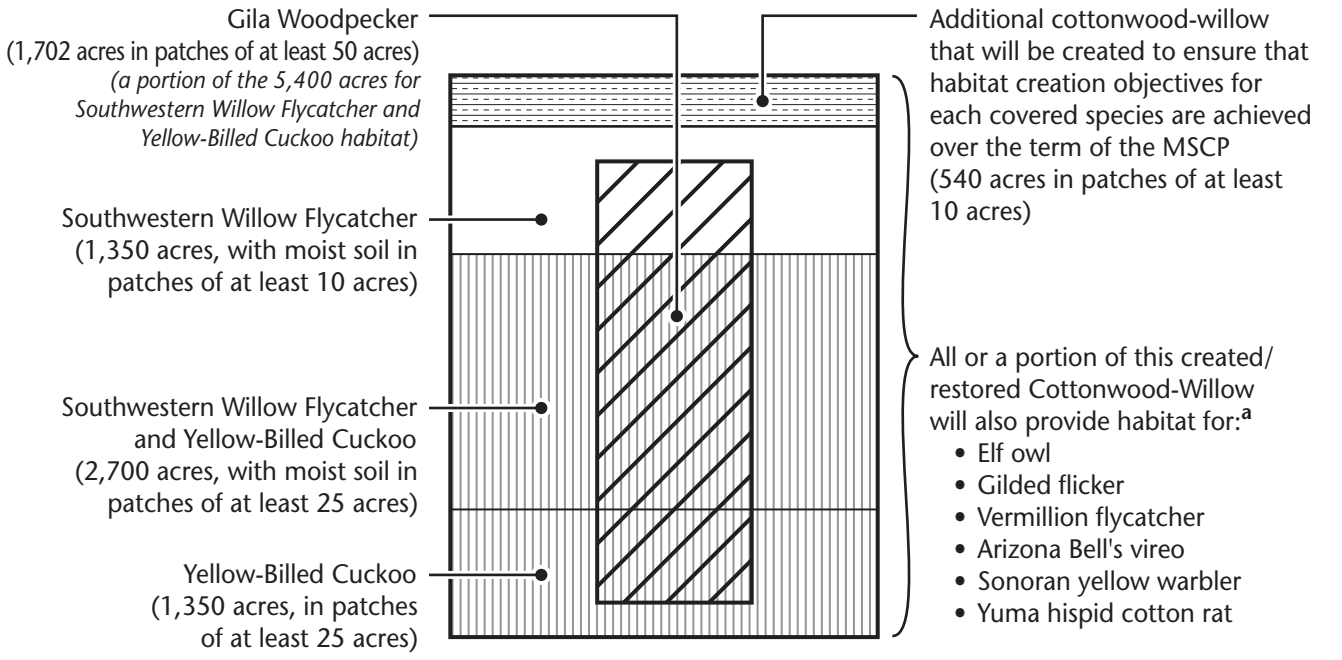
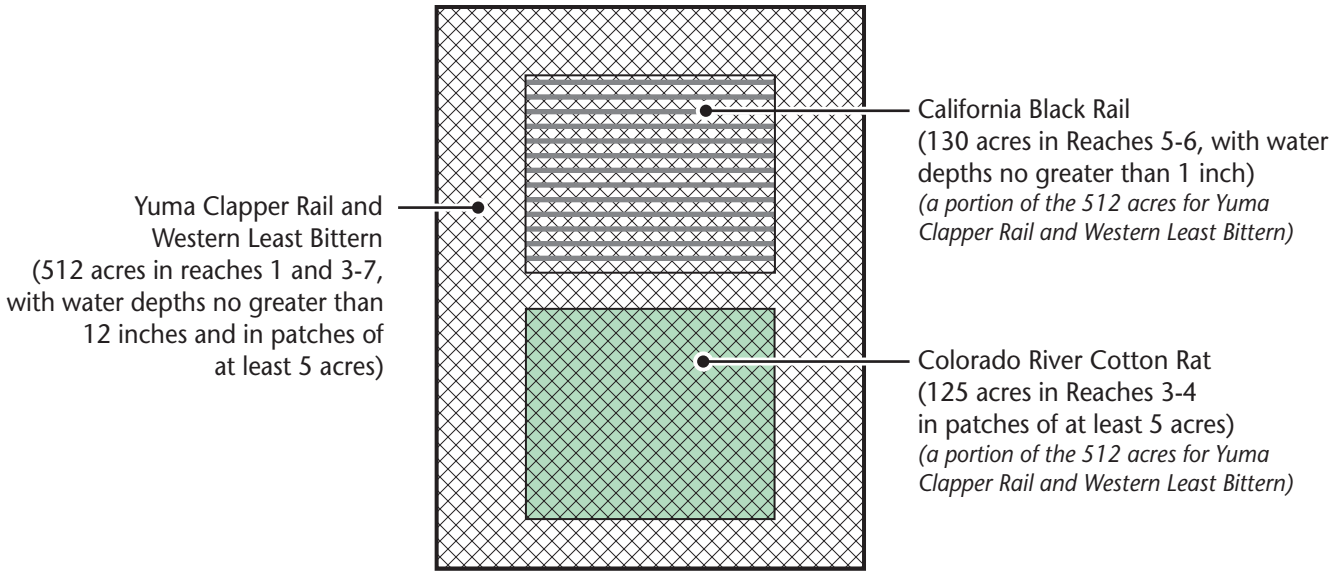
Figure 5-1
Hypothetical Distribution of Cottonwood-Willow Creation That Would Meet Habitat Requirements for All Covered Species Associated with Cottonwood-Willow



Cottonwood-Willow Creation (5,940 acres)

[a] The portion of created cottonwood-willow that will provide habitat for these species is dependent on the structure type of cottonwood-willow required by each species and the reaches in which the species occurs or is assumed to occur (Table 5-3).



Marsh Creation (512 acres)

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Figure 5-2
Proportion of Created Cottonwood-Willow and Marsh That Will Provide Habitat for Selected Covered Species

- General criteria that will be developed to select habitat maintenance projects to be funded under the LCR MSCP would include but are not be limited to, documented evidence that the:
  - habitat has degraded following approval of the LCR MSCP,
  - habitat can be improved to meet the same standards as described for covered species habitats to be created under the LCR MSCP Conservation Plan (Table 5-3),
  - extent of the habitat area encompassed by the project is sufficient to meet the needs of the covered species,
  - project is economically justified, and
  - cost sharing from the applicant is sufficient.

  Special consideration may be given to award grants for equipment and other items to support continuous maintenance programs on a broad scale.
- The habitat maintenance fund would be administered by the Program Manager, primarily through award of grants to participating agencies.
- Types of activities that could be conducted include construction of infrastructure for water delivery or movement; maintenance of marsh vegetation by burning, water delivery, and other means; maintenance of moist soil conditions in riparian land cover types (e.g., cottonwood-willow); dredging activities to create backwaters or backwater connection with the main river channel; removal or control of undesirable vegetation such as saltcedar and *Arundo*; and other appropriate means to maintain existing desirable habitat.

5.4.3 Habitat Creation Concepts

This section describes design concepts for creating cottonwood-willow, honey mesquite, marsh, and backwater land cover types to provide habitat for covered species. Habitat creation involves the direct construction of habitat that results in new habitat at sites that do not presently support habitat (e.g., establishment of cottonwood-willow stands or marsh that provides habitat for covered species on existing agricultural lands). Covered species habitat that will be established with creation of each land cover type is presented in Table 5-4.

Table 5-4. Covered Species Habitat Provided by Creation of Cottonwood-Willow, Honey Mesquite III, Marsh, and Backwater Land Cover Types

Covered Species	LCR MSCP-Created Land Cover Type			
	Cottonwood-Willow	Honey Mesquite III	Marsh	Backwater
Threatened and Endangered Species				
Yuma clapper rail			X	
Southwestern willow flycatcher	X			
Bonytail				X
Razorback sucker				X
Other Covered Species				
Western red bat	X	X		
Western yellow bat	X	X		
Colorado River cotton rat			X	
Yuma hispid cotton rat	X			
Western least bittern			X	
California black rail			X	
Yellow-billed cuckoo	X			
Elf owl	X	X		
Gilded flicker	X			
Gila woodpecker	X			
Vermilion flycatcher	X	X		
Arizona Bell's vireo	X	X		
Sonoran yellow warbler	X			
Summer tanager	X			
Flannelmouth sucker				X
MacNeill's sootywing skipper		X		

Note: X = Habitat for covered species shown in the left column could be provided within portions of the created areas of the land cover types indicated. See Sections 5.3 and 5.4 for more detailed information on the relationship between covered species habitat and land cover types.

Habitat for covered species provided by created land cover types will serve to mitigate effects of covered activities and LCR MSCP implementation on covered species. The created habitats and intended ecological functions to be provided by created habitats will be protected under the LCR MSCP. In addition, LCR MSCP–created habitats will require implementation of long-term management measures to maintain or improve the intended ecological functions of the habitat and ensure covered species goals are achieved over the term of the LCR MSCP. Management measures are expected to include such activities as implementation of irrigation schedules, fuel load reduction, and monitoring and removal of invasive nonnative flora and fauna.

Table 5-5. Extent of Covered Species Habitat That Will Be Provided with Creation of Land Cover Types

Created Land Cover Type	Species Habitat Provided by the Created Land Cover Type
Create a total of 5,940 acres of cottonwood-willow	Southwestern willow flycatcher: ▪ 2,700 acres will be created as cottonwood-willow types I–III with moist surface soil conditions during the breeding season ▪ 1,350 acres will be created as cottonwood-willow types I–IV with moist surface soil conditions during the breeding season
	Western red bat: ▪ 175 acres will be created as cottonwood-willow types I and II to provide roosting habitat[a]
	Western yellow bat: ▪ 175 acres will be created as cottonwood-willow types I and II to provide roosting habitat[a]
	Yuma hispid cotton rat: ▪ 76 acres will be created in Reaches 6 and 7 that support a moist herbaceous understory, including openings in the canopy to allow for the establishment and growth of herbaceous vegetation
	Yellow-billed cuckoo: ▪ 2,700 acres will be created as cottonwood-willow types I–III with moist surface soil conditions during the breeding season ▪ 1,350 acres will be created as cottonwood-willow types I–III
	Elf owl: ▪ 600 acres will be created as cottonwood-willow types I and II in Reaches 3–5[b]
	Gilded flicker: ▪ 4,050 acres will be created as cottonwood-willow types I–III in Reaches 3–7
	Gila woodpecker: ▪ 1,702 acres will be created as cottonwood-willow types I–IV in Reaches 3–6
	Vermilion flycatcher: ▪ 4,008 acres will be created as cottonwood-willow types I–IV
	Arizona Bell's vireo: ▪ 1,783 acres will be created as cottonwood-willow types III and IV
	Sonoran yellow warbler: ▪ 4,050 acres will be created as cottonwood-willow types I–IV
	Summer tanager: ▪ 602 acres will be created as cottonwood-willow types I and II
Create a total of 1,320 acres of honey mesquite III	Western (desert) red bat: ▪ 590 acres will be created to provide roosting habitat[a]
	Western yellow bat: ▪ 590 acres will be created to provide roosting habitat[a]
	Elf owl: ▪ 1,184 acres will be created in Reaches 3–5[b]

Created Land Cover Type	Species Habitat Provided by the Created Land Cover Type
	Vermilion flycatcher: ▪ 1,200 acres will be created
	Arizona Bell's vireo: ▪ 1,200 acres will be created
	MacNeill's sootywing skipper: ▪ 222 acres will be created with quail bush to create the honey mesquite–quail bush edge required by this species near existing occupied habitat in Reaches 1–4
Create a total of 512 acres of marsh	Yuma clapper rail: ▪ 512 acres will be created with water depths no greater than 12 inches
	Colorado River cotton rat: ▪ 125 acres will be created in Reaches 3 and 4
	Western least bittern: ▪ 512 acres will be created with water depths no greater than 12 inches
	California black rail: ▪ 130 acres will be created with water depths no greater than 1 inch in Reaches 5 and 6
Create a total of 360 acres of backwater	Bonytail: ▪ 360 acres will be created in Reaches 3–6 that achieve a rating of *good* based on the Holden et al. (1986) habitat rating system
	Razorback sucker: ▪ 360 acres will be created in Reaches 3–6 that achieve a rating of *good* based on the Holden et al. (1986) habitat rating system
	Flannelmouth sucker: ▪ Up to 85 acres will be created in Reach 3 that achieve a rating of *good* based on the Holden et al. (1986) habitat rating system

Notes:

[a] Cottonwood-willow types I and II and honey-mesquite type III provide roosting habitat for this species. The LCR MSCP Conservation Plan will provide a total of 765 acres of habitat for this species by creating a combination of 765 acres of cottonwood-willow types I and II and honey mesquite type III. The quantity of each created land cover type presented in this table is for illustrative purposes only—the actual amount of each land cover type that will be created to provide habitat for this species will depend on a number of factors, including site availability and conditions for creating each of the land cover types. For example, the habitat creation objective of 765 acres for this species could also be achieved by creating 100 acres of cottonwood-willow types I and II and 665 acres of honey mesquite type III.

[b] Cottonwood-willow types I and II and honey-mesquite type III provide elf owl habitat. The LCR MSCP Conservation Plan will provide a total of 1,784 acres of habitat for this species by creating a combination of 1,784 acres cottonwood-willow types I and II and honey mesquite type III. The quantity of each created land cover type presented in this table is for illustrative purposes only—the actual amount of each land cover type that will be created to provide elf owl habitat will depend on a number of factors, including site availability and conditions for creating each of the land cover types. For example, the habitat creation objective of 1,784 acres for this species could also be achieved by creating 1000 acres of cottonwood-willow types I and II and 784 acres of honey mesquite type III.

To the extent practicable based on site conditions, cottonwood-willow, honey mesquite, marsh, and backwaters will be created in proximity to each other to recreate integrated mosaics of habitat that approximate the relationship among aquatic and terrestrial communities historically present along the LCR floodplain.

The LCR MSCP will design and create the following amounts of each land cover type in a manner that will provide habitat for covered species that could be affected by covered activities and LCR MSCP implementation:

- 5,940 acres of cottonwood-willow,
- 1,320 acres of honey mesquite type III,
- 512 acres of marsh, and
- 360 acres of backwaters.

The extent of each created land cover type and the extent of created habitat the land cover types will provide for each covered species are summarized in Table 5-5. The minimum requirements for achieving habitat creation objectives for each species is presented in Table 5-3. Created land cover types will be designed to provide the elements of each covered species habitat in sufficient quantities to fully mitigate effects of covered activities and LCR MSCP implementation. Created land cover design and management requirements to provide habitat for each covered species are described in Section 5.7.

Patches of created land cover, in most instances, will be designed and managed to provide habitat for more than one covered species. Patches of land cover can support habitat for one or more covered species, although how each species may use the same patch of land cover may differ. For example, habitat for one species may be supported by the upper layers of canopy in a stand of riparian land cover, while habitat for another species may be supported by the understory vegetation. Therefore, affected habitat for more than one covered species can be replaced within the same footprint of created land cover, where the created land cover supports the habitat elements of each covered species. Species for which habitat can be created within the same area of land (if elements of each species habitat are present and accessible to the species) are shown in Table 5-4 and illustrated on Figures 5-1 and 5-2 for cottonwood-willow and marsh land cover, respectively.

LCR MSCP acquired lands on which land cover types are created to provide habitat for covered species will be located within designated LCR MSCP conservation areas under management of the Program Manager. The selection, design, and management of LCR MSCP conservation areas are described in Section 5.5.

The length of time that created habitats will be maintained under the LCR MSCP depends on the duration of the effects of the covered activities on covered species. The LCR MSCP HCP is unlike many HCPs submitted to the USFWS under section 10 of the ESA. HCPs generally address development or other “footprint” projects where the covered activities result in permanent, irreversible loss of habitat. In contrast, the LCR MSCP HCP includes both activities that would result in permanent loss of habitat and activities that would not. This latter type of activity includes changes in points of diversion that would result in a decrease in the water surface elevation. The decrease affects

groundwater levels and thereby affects habitat. These changes in points of diversion are largely based on leases of water with specific time limits on the lease. If the lease is not renewed, the water will revert to the original diversion point, restoring water elevations. This time limit would enable the habitat to recover once the lease was over. Some diversions, however, may extend beyond the term of the LCR MSCP, and any habitat determined to be lost as a result of these diversions would be mitigated beyond the term of the LCR MSCP, as appropriate relative to the term of effects on habitat.

The LCR MSCP commits to maintaining in perpetuity the habitat created to address permanent impacts of implementing the covered activities. This commitment will be accomplished through a variety of management options, including transfer of purchased mitigation land to a Federal, state, or appropriate private entity for permanent management for wildlife values or creating habitat on existing protected lands. Agreement by the managing entity to maintain the habitat will be acquired or, if necessary, endowments for the maintenance of the properties will be provided within the LCR MSCP budget.

5.4.3.1 Cottonwood-Willow

Cottonwood-willow land cover will be created to provide the habitat elements for the covered species described in Table 5-5. The LCR MSCP will replace 2,132 acres of cottonwood-willow that would be removed or could be degraded by non-flow-related and flow-related covered activities, respectively, with 5,940 acres of created and actively managed cottonwood-willow of higher quality than the affected land cover (Table 5-5). The vegetative composition of created cottonwood-willow land cover that provides habitat elements for the covered species will exceed the proportion of native plant species described in, and the vegetative structure will be consistent with, Anderson and Ohmart's (1976, 1984a) vegetation classification types. Cottonwood-willow land cover will be created in specific patches of land cover types, such as saltcedar and agricultural lands, that provide little or no habitat for cottonwood-willow-associated covered species (Table 3-9).

It is likely that the vast majority of existing cottonwood-willow land cover that could be affected by covered activities is of low habitat quality relative to the quality of cottonwood-willow land cover that will be created by the LCR MSCP to replace the affected cottonwood-willow. The vegetation mapping classification system used to assess impacts of the covered activities is based on Anderson and Ohmart (1976, 1984a). Under this system, as few as 10 percent of the trees in mapped patches of cottonwood-willow land cover could be cottonwood trees, with the remaining trees usually being saltcedar. Results of studies conducted by Anderson and Ohmart (1984a) along the LCR found that the diversity and abundance of wildlife tended to increase with increasing proportions of cottonwood and willow trees in riparian stands and to decrease as the proportion of saltcedar increased. Through the active management of conservation areas, the LCR MSCP will seek to achieve high densities of cottonwood willow trees and to minimize the density of saltcedar, thereby achieving higher habitat quality than most existing stands.

To the extent practicable, cottonwood-willow will be created in large patches in conjunction with honey mesquite, *Atriplex* spp., and other native riparian species and with marsh and backwater vegetation to meet the habitat requirements of the covered species and to create an integrated mosaic of functional habitats. In addition, creation of large patches of habitat will reduce the likelihood for cowbird nest parasitism on several covered bird species whose populations have declined and are now being affected by nest parasitism. Creation of cottonwood-willow in patches suitable for these species will also meet the habitat patch requirements for other covered riparian-associated species.

Depending on site-specific conditions, creation of cottonwood-willow stands may require creating canals and seasonally wet swales, creating some topographic diversity, and planting or seeding the site with cottonwoods, willows, honey mesquite, and other native riparian species, such as quail bush and saltbush. It is anticipated that most created cottonwood-willow land cover would be flood irrigated. After planting or seeding, removal of saltcedar and management of other invasive exotic species may be required. Created cottonwood-willow designed to provide southwestern willow flycatcher habitat will be specifically managed to ensure that moist surface soil, slow-moving water, or ponded water conditions are present during the breeding season to ensure the production of the flycatcher's flying insect prey base. Once established, each patch of created cottonwood-willow will be actively managed to maintain the patch attributes that are required habitat elements for the covered species (e.g., seral stages) for which the patch was intended to provide habitat.

This creation approach is designed to create cottonwood-willow stands that exceed the habitat value of existing cottonwood-willow stands, by supporting a substantially:

- greater density of cottonwood and willow trees than the 10 percent density of cottonwood and willow trees that can constitute cottonwood-willow land cover under the Anderson and Ohmart classification system (1984a),
- greater diversity of plant species than are typically associated with existing stands,
- greater abundance of insect prey production, and
- greater structural diversity associated with creation of multiple layers of vegetation and seral stages, compared to most of the potentially affected patches of cottonwood-willow land cover.

In addition, creation of patches of honey mesquite in and adjacent to patches of cottonwood-willow will:

- more closely approximate the distribution of riparian vegetation that was present along the historical gradient of the LCR floodplain and
- is expected to support an abundance and diversity of insects associated with more natural habitats, thus, contributing to the availability of prey for southwestern willow flycatchers, yellow-billed cuckoos, and other covered insectivorous species.

This approach to creating cottonwood-willow land cover will result in replacing affected existing cottonwood-willow land cover with land cover that, per unit area, will provide higher quality habitat for associated covered species than the affected cottonwood-willow. This approach is consistent with Anderson and Ohmart's (1984b) observations

that, on a per acre basis, restoring a mix of cottonwood-willow and honey mesquite habitat generally can provide substantially higher habitat values for birds and other wildlife than the value provided by dense stands of saltcedar on dry sites.

Major design elements for creating cottonwood-willow as habitat for the southwestern willow flycatcher, yellow-billed cuckoo, and other covered species include:

- creating large blocks of cottonwood-willow forest necessary to provide yellow-billed cuckoo habitat interspersed with bands of honey mesquite established at higher site elevations;
- excavating and supplying water to canals and shallow swales that dissect blocks of created forest to provide water and forest-edge conditions necessary to support southwestern willow flycatcher habitat, create the microrelief and soil moisture conditions necessary to support a diversity of understory plant species, and distribute irrigation water;
- actively managing created forest to maintain the seral stages required by covered species;
- irrigating to water and establish planted cottonwood-willow and mesquite seedlings (once stands have become established, ongoing maintenance of the native vegetation would include limiting establishment of saltcedar and other nonnative species to maintain habitat quality for associated covered species); and
- periodically irrigating, when necessary, to prevent the buildup of salts in the soil.

Successful creation of cottonwood-willow riparian forest requires that the physical processes that determine habitat structure and dynamics in riparian systems be mimicked as much as possible. In suitable locations, this component of the creation will include mimicking overbank flooding using flood irrigation, in particular in the spring and early summer, but also later in the season to maintain a shallow groundwater table. Maintaining a shallow groundwater table will help maintain herbaceous understory vegetation as well as woody riparian vegetation. Creation will also include seeding of cottonwoods and willows during the natural dispersal period or allowing for self-seeding. Following the establishment of vegetation, irrigation will continue as needed to maintain moist soil conditions during the breeding season in habitat created for southwestern willow flycatcher and to prevent the buildup of salts in the soil. In addition, stands will be managed to maintain the seral stages required by the covered species and the essential habitat parameters and minimum habitat area requirements for the southwestern willow flycatcher, yellow-billed cuckoo, and other riparian-associated covered species. Monitoring and research through the adaptive management process will guide cottonwood-willow habitat management. (Active management may include apical pruning, bole reduction, vegetative propagation via willow limb, and bole prostration in moist soil.)

5.4.3.2 Honey Mesquite

The LCR MSCP will replace 590 acres of honey mesquite land cover type III that provide habitat for the elf owl, vermilion flycatcher, and Arizona Bell's vireo that would

be removed by non-flow-related activities, with 1,320 acres of created and actively managed honey mesquite type III. The composition and structure of the created honey mesquite land cover will be consistent with Anderson and Ohmart's (1976, 1984a) vegetation classification type III. Honey mesquite will be created in conjunction with created cottonwood-willow and backwaters to form an integrated mosaic of habitats. Depending on site-specific conditions, honey mesquite may be created in small patches or as bands within created cottonwood-willow and adjacent to backwaters at suitable site elevations or as larger patches (e.g., greater than 50 acres) adjoining created or existing habitats. Created honey mesquite would be designed to:

- mimic the historical landscape patterns of plant communities along the LCR and to create an integrated mosaic of habitats;
- create high-quality habitat for the elf owl, vermilion flycatcher, Arizona Bell's vireo, and other neotropical migrants; and
- provide an abundance and diversity of insects used as food by the southwestern willow flycatcher, yellow-billed cuckoo, other covered bird species and neotropical migrants, and covered bat species by replacing existing vegetation dominated primarily by nearly monotypic stands of saltcedar.

Within the range of the MacNeill's sootywing skipper (Reaches 1–4), honey mesquite will also be planted with quail bush to create the honey mesquite–quail bush interface that provides habitat for this species.

It is anticipated that creation of large blocks of honey mesquite generally will require removing existing saltcedar-dominated stands of riparian vegetation, planting and irrigating honey mesquite seedlings, and seeding or planting native understory vegetation. Quail bush, saltbush, and other native riparian vegetation may also be planted along the perimeter of created honey mesquite where topography and soil conditions are suitable.

5.4.3.3 Marsh

The LCR MSCP will replace 243 acres of marsh that provide habitat for covered species and could be removed or degraded by non-flow-related and flow-related activities with 512 acres of marsh that provide habitat for affected covered species. Replacement marsh will be designed and managed to provide habitat for the Yuma clapper rail, California black rail, western least bittern, and Colorado River cotton rat (Table 5-5). Replacement marsh will be provided by creating new marsh in locations with suitable soils and water availability. Patches of new marsh will be created and designed and managed to provide an integrated mosaic of habitat for the Yuma clapper rail and California black rail. Creation of habitat for these species will also provide habitat for the western least bittern and Colorado River cotton rat. Habitat creation activities could include, but not be limited to:

- creating moist soil units vegetated with bulrush, with infrastructure that will allow water levels to be managed to depths required by the California black rail;
- dredging and planting emergent vegetation in newly created backwaters and marsh components of LCR MSCP conservation areas; and

- restoring hydrologic conditions in existing degraded, non-functional marsh to create marsh that functions as habitat for covered species.

Long-term management activities to maintain the created habitat could include burning, or applying other appropriate management measures, to remove dead mats of emergent vegetation to encourage growth of cattails and bulrush as the created marshes mature.

5.4.3.4 Backwater

The LCR MSCP will replace 399 acres of backwater and river channel that provide habitat for the bonytail, razorback sucker, and flannelmouth sucker that would be affected by flow-related activities, with 360 acres of created and actively managed connected and disconnected backwaters.

The backwater creation concept would create backwaters to provide habitat for the razorback sucker and bonytail and to provide surface and groundwater hydrology in support of existing or created habitat for southwestern willow flycatcher, yellow-billed cuckoo, clapper rail, elf owl, and other covered species. Disconnected backwaters isolated from nonnative fish communities in the river or reservoirs could provide habitat for a recruiting population of native fish, production facilities (grow-out or harvestable surplus of natural recruitment), and research facilities on habitat use and species interactions and would ultimately serve as refuges for these species. Backwaters that are disconnected from the LCR channel are of considerably higher value to bonytail and razorback sucker than connected backwaters in the LCR and are the preferred type of backwater to achieve LCR MSCP conservation goals for these species. (Fish reared under the LCR MSCP and stocked into these backwaters would count toward total augmentation numbers for bonytail [Section 5.7.4] and razorback sucker [Section 5.7.6].) Connected backwaters will be designed to provide the environmental conditions necessary to support adult or subadult razorback sucker, bonytail, and flannelmouth sucker. Vegetation, substrate, depth, water quality, and continuity with the adjacent river or reservoir are important habitat elements for these species.

Where possible, backwater creation will be combined with creation of riparian and marsh land cover types to provide a mosaic of land cover types. Backwaters will be designed to provide for the establishment of bulrush and cattail along the edges. Depending on the extent of marsh vegetation established at each site, breeding and/or dispersal habitat may be created for the Yuma clapper rail. Backwater creation within or adjacent to existing or created patches of riparian vegetation provides the two major components of southwestern willow flycatcher breeding habitat—structure for nest site placement and standing water and saturated soils for production of insect prey. Backwaters, integral to flycatcher breeding habitat, will be designed and managed to maintain standing water and moist soils during the southwestern willow flycatcher breeding season. Where backwaters are created in or adjacent to extensive stands of riparian forest, they will also contribute to maintaining the humid microclimate conditions required by nesting yellow-billed cuckoos.

5.4.4 Fish Augmentation Strategies

In addition to replacing covered fish species habitat affected by covered activities, the LCR MSCP will rear and stock fish to augment the existing population of razorback sucker and bonytail in the LCR. To offset any potential take of razorback sucker and bonytail, the LCR MSCP commits to providing the level of funding necessary to produce:

- up to 660,000 subadult razorback suckers (at least 300 millimeters [mm] in length) and
- up to 620,000 bonytail (at least 300 mm in length).

These augmentations will be structured as described in Sections 5.7.4.2 and 5.7.6.2. Funds not used for production of fish will be used for other management activities that will benefit the populations of both species.

Existing fish rearing capacity and aquacultural techniques may initially be insufficient to meet the augmentation objectives described above. Accordingly, in the initial years of LCR MSCP implementation, the LCR MSCP will:

- monitor the response of razorback suckers to previous augmentations and stock the numbers of razorback sucker that can be produced up to the amounts described above;
- assess the efficacy of existing or proposed bonytail production programs and facilities and develop the methods required to produce and rear the fish;
- increase rearing capacity, if necessary, in cooperation among AGFD, CDFG, NDOW, USFWS, and other LCR MSCP participants, or fish may be acquired from other sources; and
- construct, in the context of the integrated landscape mosaic, a "pilot project" for isolated backwaters that can be used for recruiting populations, grow-out facilities, or research within the LCR MSCP planning area.

The LCR MSCP will also monitor fish response to augmentations and conduct adaptive management experiments to collect information necessary to evaluate and adaptively manage implementation to better ensure species goals are achieved. Specific activities related to augmentation of the bonytail and razorback sucker are presented in Sections 5.7.4.2 and 5.7.6.2, respectively.

5.4.5 Other Conservation Strategies

5.4.5.1 Contribute to Ongoing Conservation Programs

The LCR MSCP will contribute up to $1.25 million to entities charged with ongoing programs to conserve LCR MSCP covered species within and outside of the LCR MSCP planning area. Funding will be provided only to implement species conservation

activities that have been identified to contribute to the conservation of the species and for which other funding is not available. Covered species for which the LCR MSCP will fund conservation measures through other ongoing programs include the relict leopard frog, humpback chub, flannelmouth sucker, sticky buckwheat, and threecorner milkvetch. Specific LCR MSCP funding levels for conservation of these species are described in Section 5.7, "Species-Specific Conservation Measures."

5.4.5.2 Covered Species Population Enhancement

Species-specific population enhancement conservation measures are designed to address species conservation needs that cannot be addressed through maintenance of existing habitat or creation of habitat. Examples of population enhancement measures include collecting wild fish spawn, raising brood and young fish at hatcheries and rearing ponds, and releasing them into the river and backwaters; controlling piscivorous fish and nonnative amphibians in advance of releases into created backwaters; placing nest boxes in created cottonwood-willow land cover to increase nesting success for cavity-nesting species; and controlling brown-headed cowbirds to reduce adverse effects of nest parasitism on covered species. Specific descriptions of population enhancement conservation measures are presented in Section 5.6.2, "Monitoring and Research Measures," and Section 5.7, "Species-Specific Conservation Measures."

5.4.5.3 Protection of Existing Habitat

As described in Section 5.4.3, the habitat conservation element of the LCR MSCP Conservation Plan is directed toward creating new covered species habitats to replace affected habitats and contribute to the recovery of covered species. Under specific circumstances, however, existing unprotected covered species habitats may be acquired, protected, and managed under the LCR MSCP to prevent their future loss or degradation. If existing habitat is protected under the LCR MSCP, the extent of the protected covered species habitat will be credited in lieu of an equal amount of the applicable covered species habitat to be created under the LCR MSCP Conservation Plan (e.g., if 100 acres of existing southwestern willow flycatcher habitat are acquired and protected, 100 fewer acres would be created than is identified in the LCR MSCP Conservation Plan). For existing unprotected habitat to be protected and managed under the LCR MSCP, the Program Manager will evaluate each identified property on a case-by-case basis in accordance to the following criteria and procedures:

1. The habitat area must be clearly in imminent danger of being permanently lost, or in danger of significant long-term degradation, as a result of on-the-ground development activities or other irreversible activities. The Program Manager will complete an analysis of threats to the habitat area and demonstrate why the habitat area is in imminent danger of being lost.
2. The habitat area should be on private or other lands under a status that provides no or limited protection for resource values.
3. At the time of consideration, the habitat area must provide habitat as defined in Table 5-3 of the LCR MSCP Conservation Plan for one or more covered species.

4. The value of the habitat will be documented as part of the evaluation of the property before acquisition is proposed. This evaluation will include an assessment of the habitat area relative to requirements for covered species habitats that will be created under the LCR MSCP Conservation Plan. Existing habitat areas must meet the same standards as described for covered species habitats to be created under the LCR MSCP Conservation Plan (Table 5-3). These standards include, but are not limited to, size of the habitat, vegetative structure, location within the planning area, need for buffer areas to protect the habitat from offsite disturbances, and certainty of water availability to support the habitat in the future.
5. The acquisition of the property must be economically justifiable within the budget of the LCR MSCP. Further, the costs of managing and maintaining the property as covered species habitat over the term of the LCR MSCP must also be within the budgeted range of such costs for LCR MSCP–created habitats.
6. The USFWS, Program Manager, and LCR MSCP Steering Committee must agree that the acquisition is appropriate to contribute to meeting the mitigation responsibilities of the LCR MSCP.
7. Once the identified property is acquired, the extent of habitat area credited as LCR MSCP habitat must be maintained to continue to provide at least that extent of habitat over time. If it is destroyed or degraded, for any reason, replacement of the habitat is required under the same conditions as for replacement of created habitats that are lost.

5.4.5.4 Avoidance and Minimization of Impacts

The LCR MSCP includes measures to avoid and minimize impacts of implementing covered activities and the LCR MSCP Conservation Plan on covered and evaluation species. Examples of such measures include avoiding declines in groundwater and surface water elevations by installing infrastructure to maintain water elevations and designing LCR MSCP–created habitats to avoid removal of cottonwood-willow land cover and southwestern willow flycatcher habitat. Specific descriptions of avoidance and minimization conservation measures are presented in Section 5.6.1, "Avoidance and Minimization Measures," and Section 5.7, "Species-Specific Conservation Measures."

5.5 Conservation Area Site Selection, Design, and Management

The selection, design, and management of a system of conservation areas are central elements of the LCR MSCP for creating habitat for covered species and achieving conservation goals for LCR MSCP species. Conservation areas are lands on which land cover types will be created to establish new habitat for covered species to mitigate impacts of covered activities and LCR MSCP implementation on existing habitat for covered species. Once established, conservation areas will be maintained and managed to ensure continued habitat persistence and function.

The Program Manager is responsible for initially evaluating and selecting conservation areas, developing conservation area designs, and developing conservation area management plans. Because conservation areas have not yet been identified, site-specific habitat creation design and management criteria (e.g., need for and configuration of buffers) will necessarily be developed and applied within the guidelines described in this section as each conservation area is identified. Technical subcommittees or workgroups established by the LCR MSCP Steering Committee may participate in the selection and design of and management planning for conservation areas and all conservation area designs and management plans will be reviewed by USFWS before they are implemented.

5.5.1 Conservation Area Site Selection

The LCR MSCP will create 8,132 acres of habitat for covered species. The LCR MSCP will select conservation areas in which to create habitat from:

- among 30 potentially suitable habitat creation sites that have been initially identified, surveyed, and evaluated by the LCR MSCP (Ogden Environmental and Energy Services 1999; CH2M Hill 1999; SWCA Environmental Consultants 2000; Inter-Agency Team 1999, 2000a, 2000b, 2000c; SAIC/Jones & Stokes 2001);
- available agricultural lands; and
- other undeveloped lands.

Approximately 37,500 acres are present in the 30 initially identified conservation areas (Table 5-6, Figure 5-3), and approximately 270,500 acres of agricultural lands are present in the LCR MSCP planning area (Table 5-7). Consequently, sufficient suitable sites would be available to the LCR MSCP to successfully create the 8,132 acres of habitat (representing approximately 3 percent of the lands identified in Tables 5-6 and 5-7) required to achieve goals for covered species.

Table 5-6 lists the initially identified conservation areas. These areas are not likely to be the only conservation areas. As additional information is gathered regarding other conservation areas, more sites may be added to the list of conservation areas, using the site-selection criteria described below.

The process for selecting conservation areas will involve application of site-selection criteria and will require collection of sufficient information to properly evaluate the potential for the successful creation of habitat before conservation areas are acquired. It is the intent of the LCR MSCP to create habitats in locations and patch sizes that will best meet the conservation needs of the covered species and to manage those habitats in a manner that will meet species seasonal habitat requirements, within the constraints associated with land availability. Conservation site-selection criteria will include:

- presence of and proximity to existing occupied covered species habitats,
- suitability of site conditions for creating habitat for specific species (e.g., appropriate soils, availability of water for irrigation),

Table 5-6. Summary of Initially Identified Conservation Areas

Potential Conservation Area	River Mile	Ownership Status[a]	Total Area[b] (acres)	Cottonwood-Willow	Honey Mesquite III	Riparian[c]	Marsh
Hualapai Wilderness Riparian Restoration	GC 243–260	T	60	0	0	60	0
Hualapai Lost Creek Riparian Improvement	GC 247	T	2	1	0	0	0
Lake Mead Riparian Restoration[d]	418–343	F	500	0	0	500	0
Lake Mohave Riparian Restoration[e]	326–278	F	200	ND	ND	ND	ND
Backwaters and Sloughs I	266–264	S	450	100	250	0	50
Cimarron Agricultural Conversion	254–253.3	T	97	97	0	0	0
Long Lake	254–252	T	570	0	0	562	0
Piute Wash Restoration	251.5	T	630	20	200	0	0
Twin Lakes	251–249	T	165	150	0	0	0
Section 33 Agricultural Conversion	250.5	T	150	150	0	0	0
Section 20 Riparian and Native Fish Restoration	243–244	T	1,326	0	0	1,226	0
Chemehuevi Rearing Pond Cove Enhancements	216–208.5	T	54	ND	ND	ND	ND
Chemehuevi Wilderness Riparian Restoration	212.5–208.5	T	124	124	0	0	0
Chemehuevi Agricultural Conversion	Chem Res	T	40	40	0	0	0
Chemehuevi Desert Wash Revegetation	Chem Res	T	100	ND	ND	ND	ND
'Ahakhav Tribal Preserve	175–169	T	1,010	280	530	0	0
Mohave and Deer Tail Backwaters	169–166	T	800	170	540	0	0
A7 Backwater	121–117	S	1,560	670	590	0	0
A10 Backwater	115–114	F	220	110	80	0	0
Swendt Slough	111–110	F	235	50	160	0	0
Cibola Valley Irrigation and Drainage District	110–107	P	1,030	515	515	0	0
BLM Agricultural Leases within PVID	107–102	F	2,200	2,110	60	0	0
Cibola Meander, Arizona Side	104.5–101.5	P	1,040	700	300	0	0
Palo Verde Oxbow Enhancement	102–100	P,F	1,560	620	20	0	0
Sempre Property Land Acquisition	113–96.5	P	17,000	ND	ND	ND	0
Cibola Restoration Concepts	96–88	R,F	230	70	110	0	0
Laguna Old Channel Restoration	49–43	S	1,425	770	420	0	0

Potential Conservation Area	River Mile	Ownership Status[a]	Total Area[b] (acres)	Cottonwood-Willow	Honey Mesquite III	Riparian[c]	Marsh
Yuma East Wetlands Pilot Project	34.2–30.8	S,T,F,P	1,305	580	0	0	0
Cocopah Tribal Enhancement Proposal	27–9	T	1,223	0	0	1,223	0
Limitrophe BLM Habitat Restoration	8–0	F	770	740	20	0	0
Total			**37,526**	**7,917**	**3,795**	**3,571**	**50**

Notes:

ND = no data available
GC = Grand Canyon
Chem Res = Chemehuevi Indian Reservation
BLM = Bureau of Land Management

[a] Ownership Status Symbols:
F = Federal (non refuge)
R = national wildlife refuge
S = state
T = tribal
P = private

[b] The total extent of potential conservation areas may include land cover types (e.g., developed lands and desert scrub) that are not suitable for creation of covered species habitat. Consequently, the total extent of created habitat may be less than the total extent of the conservation area.

[c] The design for the specific composition of this created riparian land cover has not yet been developed. Land cover types could include cottonwood-willow, honey mesquite, arrowweed, atriplex, and other riparian land cover types.

[d] Habitat created in this potential conservation area would be in addition to the Federal covered activities described in the LCR MSCP BA that will also restore habitat at Lake Mead.

[e] Habitat created in this potential conservation area would be in addition to the Federal covered activities described in the LCR MSCP BA that will also restore habitat at Lake Mohave.

Table 5-7. Agricultural Land by River Reach and Landowner Category

River Reach[a]	Owner Category	Agricultural Land (acres)
Reach 3	Federal/state refuge	222
	Tribal	11,510
	Private	5,789
	Not identified[b]	0
	Total	19,159
Reach 4	Federal/state refuge	1,551
	Other Federal/state	8,874
	Tribal	78,061
	Private	81,118
	Not identified[b]	0
	Total	169,604
Reach 5	Federal/state refuge	256
	Other Federal/state	4
	Total	260
Reach 6	Federal/state refuge	65
	Other Federal/state	3,314
	Tribal	7,292
	Private	25,207
	Not identified[b]	908
	Total	36,786
Reach 7	Other Federal/state	1,847
	Tribal	883
	Private	41,943
	Not identified[b]	32
	Total	44,705
All Reaches	Federal/state refuge	2,096
	Other Federal/state	15,677
	Tribal	97,745
	Private	154,057
	Not identified[b]	940
	Grand total	270,514

Note: Land cover type areas in this table do not match exactly with areas in Table 3-9 because when the land ownership database was combined with the land cover type databases, small sliver polygons were created that could not be assigned to any land cover type.

[a] No Lower Colorado River Accounting System agricultural landowner data are available for Reaches 1 and 2.

[b] No landowner data is available; however landowners could include any of the other landowner categories.

Sources: Bureau of Reclamation 1997 (supplemented in 2002), 2001a.

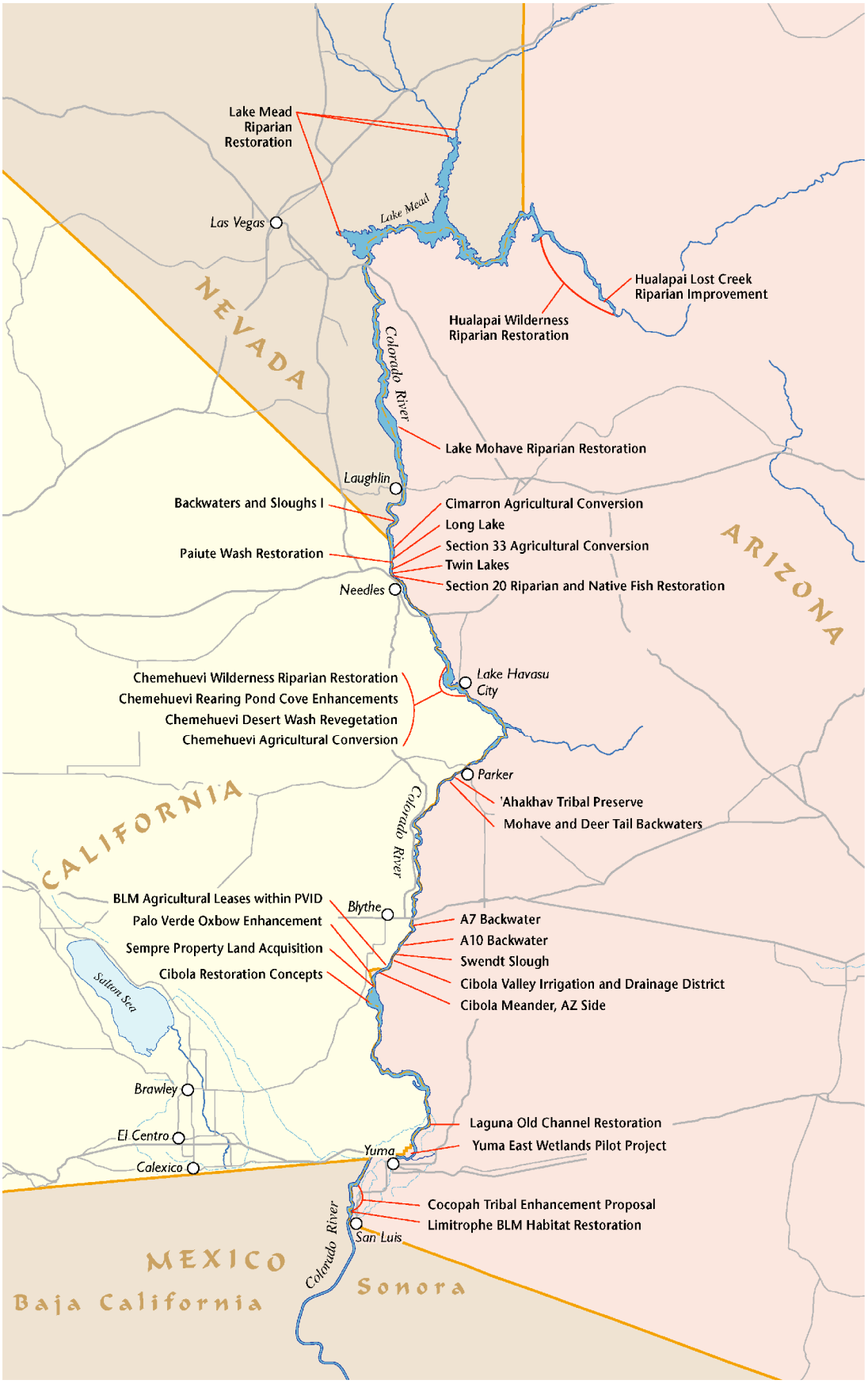


Figure 5-3
Lower Colorado River MSCP
Initially Identified Conservation Areas

00450.00-303

- available requisite infrastructure (e.g., access roads, irrigation-related infrastructure),
- relative suitability for achieving multiple creation objectives through an integrated mosaic of habitat types,
- likelihood for mosquitoes produced on a site to become a vector control or nuisance problem based on proximity to urban areas and mosquito production potential,
- cost of land acquisition (e.g., fee title, conservation easement, lease),
- timing of land availability relative to the need for implementing habitat creation measures,
- consideration of zoning and general plan designations,
- relative cost of implementing and maintaining created habitat, and
- availability and cost of water to meet creation and maintenance requirements.

5.5.2 Conservation Area Design Concepts

Once the location of conservation areas is determined based on the site-selection criteria, a conservation area design plan will be developed specific to the conservation area to meet covered species' needs. The conservation area design plans will incorporate created habitat, existing habitat if present, and, if necessary, buffer areas to protect conservation area habitats from activities on adjacent lands that could degrade LCR MSCP habitats. Important conservation area design concepts that will guide implementation of the habitat creation element of the LCR MSCP are described below.

1. Habitat will be created in patches equal to or greater than the patch sizes required to support sustainable occupancy of the target-covered species.
2. LCR MSCP conservation areas will be designed to create an integrated mosaic of vegetation to approximate the historical juxtaposition of communities along the LCR. Examples of how this may be accomplished include:
    a. approximating the historical floodplain community by establishing an integrated mosaic of patches of cottonwood-willow, honey mesquite, *Atriplex* spp., other native riparian species, and backwater and emergent vegetation and
    b. creating habitat in locations where, in combination with existing adjacent habitat, habitat mosaics are created or enhanced.
3. Created habitat for species with limited distribution along the LCR and with limited ability to move among habitat patches along the LCR will be located near known populations to facilitate future occupancy of created habitats.
4. To create large patches of habitat that will be more likely to support high numbers of associated covered species, priority will be given to creating habitat near existing habitats.
5. To the extent consistent with the conservation area site-selection criteria, preference will be accorded to locating created habitat on Federal, state, and tribal lands. If suitable public lands are not available, private land will be considered on the

principle of willing seller or lessor. Preference will also be given to the acquisition of large tracts to facilitate the creation of large patches of habitat.

6. Management of conservation areas includes a commitment to:

   a. reduce the risk of the loss of created habitat to wildfire by providing resources to suppress wildfires (e.g., contributing to and integrating with local, state, and Federal agency fire management plans),

   b. design conservation areas to contain wildfire and facilitate rapid response to suppress fires (e.g., fire management plans will be an element of each conservation area management plan), and

   c. implement land management and habitat creation measures in conservation areas to support the reestablishment of native vegetation that is lost to wildfire.

7. Conservation areas will, as needed, incorporate buffer areas to minimize the potential effects of wildfire, existing land uses, and other activities that may be associated with adjacent lands that could adversely affect the ecological functions associated with created habitats. Conservation areas will be designed to minimize the need for buffers by locating, juxtaposing, and managing created habitats in a manner that will minimize the effect of activities/events that may occur on adjacent lands. The need for buffer lands will be determined based on the site-specific needs identified for each conservation area. Lands acquired and designated as buffers for conservation areas will not be lands that are created as covered species habitat. To avoid potential impacts to aircraft from increases in bird populations, the conservation measures would be implemented consistent with Federal Aviation Administration (FAA) Guidelines.

8. Conservation areas will be located and designed to incorporate, to the greatest extent practicable, existing infrastructure and to minimize the need for construction of new infrastructure required for establishment and management of habitats. The extent of land required for new infrastructure to manage conservation areas will be based on site-specific needs identified for each conservation area, and lands required for new infrastructure will be in addition to lands used to create covered species habitat.

9. Design and management of conservation areas will be coordinated with appropriate local health officials to incorporate, to the extent practicable, design and management concepts to help reduce the likelihood that conservation areas could produce mosquitoes in numbers that could cause public health or nuisance concerns. Access to conservation areas will be provided to mosquito abatement district officials to monitor mosquito populations.

5.5.3 Conservation Area Management

A management plan will be developed and implemented for each conservation area. Major elements addressed by the management plans should include:

- habitat objectives for the conservation area,
- monitoring requirements,
- fire management,

- predator/competitor management,
- vegetation management,
- infrastructure maintenance,
- permitted uses, and
- water management.

It is anticipated that conservation area management plans will need to be periodically revised to reflect new information that is collected through monitoring and research (Section 5.11).

5.5.4 Conservation Area Mainstream Water Use and Management

The purpose of this section is to identify and briefly describe the anticipated mainstream water uses associated with implementation of LCR MSCP habitat conservation and creation activities. These potential water uses are a critical element of the proposed conservation measures. As has been discussed previously, the specific habitat creation and conservation sites have not yet been identified. However, there are approximately 36,500 acres within sites that have been preliminarily identified, surveyed, and evaluated and are potentially suitable for habitat creation (Section 5.5.1) under the LCR MSCP.

It is generally anticipated that most, if not all, of the sites will require permanent or periodic applications of mainstream water to enhance and maintain the desired habitat conditions and promote species conservation benefits. Most sites will require water during the habitat creation project construction and development periods. Once the habitat has been established, mainstream water use on the site would generally be determined by annual irrigation needs for trees and ground covers, seasonal moist-soil creation, maintenance of open water and marsh areas, and other management needs as identified. Generally, mainstream water will be required over the 50-year term of the LCR MSCP.

This section of the LCR MSCP is not intended to distinguish the legal or entitlement aspects related to the proposed types of mainstream water use associated with the habitat creation, maintenance, and species conservation activities contemplated with implementation of the LCR MSCP conservation measures. Sources of water supply other than the Colorado River may become available during the 50-year implementation period of the LCR MSCP. Any water source that would be required to implement the conservation measures would be analyzed during the LCR MSCP site selection process. This section only purports to identify the various types of mainstream water uses that may be required in conjunction with specific habitat creation, habitat maintenance, and other types of species conservation activities. Generally, these activities include:

- establishment and maintenance of native riparian vegetation,
- establishment and maintenance of marsh land cover,
- establishment and maintenance of backwaters, and

- establishment and operation of native fish hatchery and rearing facilities.

Additionally, permutations associated with each of these activities are briefly described in the following sections.

5.5.4.1 Establishment and Maintenance of Cottonwood-Willow and Honey Mesquite Land Cover Types

This type of proposed habitat creation and maintenance activity involves the establishment, or reestablishment, of native riparian vegetation on specific tracts of land within the LCR MSCP planning area, largely from Davis Dam to the SIB with Mexico, to create habitat for associated covered species. The target land cover types in this category are cottonwood-willow and honey mesquite, as well as the associated understory communities of native plants (e.g., shrubs, forbs, grasses). The LCR MSCP proposes to create and maintain 5,940 acres of cottonwood-willow and 1,320 acres of honey mesquite land cover types within the LCR MSCP planning area to provide habitat for associated covered species.

The habitat creation concepts proposed for these land cover types involve the replacement of existing poor-quality patches of riparian vegetation (e.g., monotypic stands of saltcedar) with an integrated mosaic of native riparian vegetation, including cottonwood-willow (near water or in areas of acceptable groundwater depths) with an understory of varying amounts of shrubs (e.g., *Atriplex* spp., wolfberry) and other forbs and grasses, and mesquite bosques established in the drier or more upland sites (e.g., second-terrace floodplain). A second habitat creation concept involves the establishment of cottonwood-willow and honey mesquite land cover on existing agricultural land. Potential mainstream water use attributes associated with these concepts involve a number of different activities that are described below.

Mainstream Water Use Attributes Associated with Creation of Cottonwood-Willow and Honey Mesquite Land Cover

The potential water use attributes associated with creation of cottonwood-willow and honey mesquite land cover may include site preparation, establishment irrigation, maintenance irrigation, and managed flooding. Each of these attributes is described below.

- Site preparation—After clearing and root-ripping to remove the exotic vegetation, soil conditioning or leaching of salts may be necessary. This work may require several applications of mainstream water to create appropriate soil conditions prior to revegetation with the desired native riparian plant species. Water use needs for site preparation are probably not necessary, or are very limited, on sites involving the conversion of lands in agricultural crop production to support stands of cottonwood-willow and honey mesquite. Depending on the existing conditions of the soil column

at the proposed habitat creation site, site preparation water use may be necessary for only one growing season.

- Establishment irrigation—Water use for establishment irrigation is necessary to ensure that the recently planted native plant species are maintained and to promote vigorous growth. Typically, on sites with undulating or uneven topography, this irrigation will involve the application of mainstream water via sprinkler or drip irrigation systems (recognizing that most of the selected sites should be favorable for flood irrigation practices or would be graded and leveled during site preparation, but that sprinklers could be used under special or local conditions). On lands converted from agricultural crop production, the land may be level enough to facilitate flood irrigation using the existing water conveyance infrastructure. Generally, it is expected that establishment irrigation will be required at specific sites for 1–3 years following revegetation until the young tree root systems are able to reach the water table.

- Maintenance irrigation—Water use for maintenance irrigation may be necessary to maintain overall plant health and vigor in sites where depth to water is beyond the ability of the plant's root system to access. This ability to access water may be more of an issue for the cottonwood-willow and associated shrub and forb understory communities than for mesquite species (i.e., mesquite has been shown to exhibit rooting depths in excess of 50 feet) (Stromberg et al. 1992). At some sites, it may be desirable or feasible to lower the grade in order to ensure adequate depths to water for mature riparian plant species, thus limiting maintenance irrigation requirements. Depending on specific site characteristics, maintenance irrigation may be required one or more times annually during the 50-year term of the LCR MSCP, particularly for the created patches of cottonwood-willow land cover.

- Managed flooding—Water use for managed flooding is intended to simulate predevelopment hydrologic conditions along the LCR. The concept involves flooding or irrigating the established patch of riparian vegetation from late February to late March or early April, during the seed germination period for cottonwood-willow. Obviously, this technique requires the presence of a number of mature cottonwood and willow seed source trees in proximity to the habitat creation site. This managed flooding promotes recruitment of juvenile cohorts of cottonwood and willow species and maintains adequate soil conditions. Managed flooding may be desirable at some sites on an annual basis, but at other sites it may be necessary only every 2–3 years. Because of the current paucity of seed trees within the planning area, this technique may be somewhat limited during the first decade of LCR MSCP implementation until more mature trees are present in areas suitable for habitat creation.

Managed flooding may also be required to maintain adequate or suitable soil-moisture content at specific habitat creation sites. Adequate soil moisture promotes healthy macrobiotic and microbiotic conditions and the production of flying insects important to many of the LCR MSCP–covered species (e.g., southwestern willow flycatcher, bats). This aspect of managed flooding could be accomplished, in some cases, with the February–April flooding requirements for seed germination but may also be required one or more times during the heat of the summer if the soil conditions warrant.

Finally, a third type of managed flooding involves maintaining saturated soils or standing water in and adjacent to created stands of cottonwood-willow associated with occupied southwestern willow flycatcher habitat from May 1 to August 30. This habitat characteristic is highly desirable to promote successful breeding and recruitment of neotropical migrant bird species. Consequently, at sites currently occupied by southwestern willow flycatcher or sites that over time become flycatcher territories and nesting sites, it may be necessary to include this water use as well. It may be possible to use adjacent marsh or backwater land cover types to meet this requirement as well.

Based on the proposed creation of 5,940 acres of cottonwood-willow and 1,320 acres of honey mesquite land cover types, a preliminary analysis indicates that approximately 34,480 afy of mainstream water would be required per year to meet the CU of the created habitat. This amount is based on an average evapotranspiration (ET) rate of 4.74 afy per acre for cottonwood-willow land cover and 4.79 afy per acre for mesquite land cover.[1] Additionally, it has been estimated that an additional 8,600 afy may be required for the periodic managed flooding events. This water is particularly important for the created and maintained stands of cottonwood-willow because these stands must maintain certain specific macrosite and microsite characteristics to function as habitat for covered species.

5.5.4.2 Creation and Maintenance of Marsh Land Cover

Creation and maintenance of native marsh vegetation along the LCR are considered critical elements in ensuring adequate conservation for LCR MSCP covered species, including Yuma clapper rail, California black rail, and western least bittern. Implementation of the LCR MSCP conservation measures would result in the creation and maintenance of 512 acres of marsh land cover as habitat for associated covered species within the LCR MSCP planning area.

Typically, the appropriate LCR marsh land cover type comprises a mosaic of marsh vegetation, including tule, cattail, and common reed, as well as trees, grasses, open water, and mudflats. Generally, the marsh vegetation component ranges from 25 to 100 percent of the total land cover.

Marsh creation activities could be included in the design of backwater creation projects. Additionally, marsh vegetation could be developed in conjunction with large-scale establishment of native riparian vegetation, where there would be open water areas with associated marshes created as part of the integrated mosaic concept.

Existing backwaters could be resculpted with shallow benches at the land/water interface to allow for establishment of additional patches of marsh vegetation (e.g., cattail, bulrush habitat). California black rail requires marsh with moist soils and surface water areas up to 1 inch deep, while the water depth for Yuma clapper rails should not exceed 12 inches.

[1] The average ET rate was calculated using data reported in Reclamation's calendar year (CY)–1999 LCRAS Annual Report and was based on ET rates reported for three reaches of the mainstream (i.e., Davis Dam to Parker Dam, Parker Dam to Imperial Dam, and Imperial Dam to the SIB) (Bureau of Reclamation 2000b).

Mainstream Water Use Attributes Associated with Creation of Marsh Land Cover Creation

The potential water use attributes associated with creation of native marsh may include the following: existing backwater enhancement and/or enlargement and new backwater and marsh creation. Each of these attributes is described below.

- Existing backwater enhancement/enlargement—To create functional marshes, it may be feasible and desirable to restructure existing backwater features within the LCR MSCP planning area. This restructuring may involve the use of amphibious excavators to enlarge and reshape the interface between the backwater and the floodplain. Benches and shelves could be sculpted to create the shallow water conditions necessary to promote establishment and maintenance of marsh vegetation for both the Yuma clapper rail and California black rail. The potential mainstream water use is associated with increased open water surface area and evaporation, as well as additional CU related to the ET by the marsh vegetation.
- New backwater and marsh creation—In conjunction with the creation of large patches of native riparian vegetation or isolated native fish refugia in the floodplain, it may be feasible and desirable to create functioning patches of marsh at the interface between the backwater and riparian vegetation. The potential mainstream water use is related to open water evaporation and the ET of the marsh vegetation.

The proposed creation and maintenance of 512 acres of marsh land cover would require an estimated 3,000 af of mainstream water per year. This amount is based on an average ET rate of 5.77 af per acre per year. Again, this average ET rate was calculated from data reported in Reclamation's calendar year (CY)–1999 LCRAS annual report for the three mainstream reaches of the Colorado River below Davis Dam.

5.5.4.3 Establishment and Maintenance of Backwaters

The proposed backwater creation and maintenance concept would create and enhance backwaters to provide habitat and conditions for bonytail, razorback sucker, and flannelmouth sucker. Additionally, the created and maintained backwaters will provide surface and groundwater hydrologic conditions in support of the habitat creation and maintenance activities for southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, California black rail, and other covered species. Created and maintained backwaters within the LCR MSCP are considered a critical component of the integrated mosaic concept. The proposed LCR MSCP conservation measures would lead to the creation and maintenance of 360 acres of actively managed connected and disconnected backwaters within the LCR MSCP planning area. Potential mainstream water use attributes associated with these habitat creation activities are described in the following section.

5.5.4.4 Mainstream Water Use Attributes Associated with Creation of Backwater

The potential water use attributes associated with creation of the actively managed connected or disconnected backwaters may include the following: enhancement and/or enlargement of existing connected or disconnected backwaters and new backwater and marsh creation. Each of these attributes is described below.

- Enhancement and/or enlargement of existing connected or disconnected backwaters—This habitat creation concept, like marsh habitat creation, involves enhancement or enlargement of existing backwaters and the creation of new backwaters adjacent to the mainstream or in the floodplain. Existing backwaters could be modified to provide improved water flow and water quality through the backwater (e.g., culverts, gate structures, percolation dike structures, openings directly to the mainstream). Backwaters could be divided into zones to better facilitate management of native fish and desired aquatic characteristics. The potential mainstream water use associated with enhanced or modified backwater creation activities is related to evaporation and bank storage.
- New backwater and marsh creation—In conjunction with the creation of large patches of cottonwood-willow, honey mesquite, and marsh land cover types, it may be desirable to construct isolated native fish refugia in the floodplain. These refugia could involve reestablishment of a hydrologic connection in a relict channel feature, remnant backwater, swale, or slough. Typically, this reestablishment involves lowering the grade of the land surface in the relict channel feature or diversion (e.g., via direct diversion from the mainstream and conveyance or supplied by groundwater pumping from wells in the floodplain) and conveyance of a water supply to the feature.

In the integrated mosaic concept, it is likely that functioning patches of marsh would be established around the fringe of the new backwater. The potential mainstream water use is related to open water evaporation, bank storage, and the ET of the associated marsh vegetation.

The proposed creation and maintenance of 360 acres of backwater would require an estimated 1,900 af of mainstream water per year. This amount is based on an average ET and evaporation rate of 5.17 af per acre per year. Again, this average evaporation and ET rate was calculated from data reported in Reclamation's CY-1999 LCRAS annual report for the three mainstream reaches of the Colorado River below Davis Dam.

5.5.4.5 Establishment and Operation of Native Fish Hatchery and Rearing Facilities

To produce sufficient numbers of native endangered fishes for reintroduction into suitable LCR mainstream habitats, it is likely that additional native fish production facilities will be required. Some of these hatchery facilities may be constructed off-stream, which is outside of the LCR MSCP planning area. No mainstream water use would be associated with these off-stream facilities. At suitable sites within the planning

area, it may make economic sense to construct the facility in the adjacent floodplain, thus reducing transport costs and the transit time associated with moving the fish from the facility to the reintroduction site.

Hatchery facilities would involve the construction and maintenance of raceways and grow-out ponds. Mainstream water, either directly pumped from the river or from wells in the floodplain, would provide the water supply for these activities. The potential mainstream water use attributes are generally associated with open water evaporation and bank storage in unlined earthen ponds and/or evaporation from lined ponds or raceways. The amount of water that could be required for hatchery and rearing facilities would be based on the CU through evaporation.

5.5.4.6 Summary of Conservation Area Mainstream Water Use and Management Needs

As has been described, the potential requirements for the use of mainstream Colorado River water include the following types of activities:

- conservation area site preparation;
- establishment and maintenance of riparian, marsh/wetland, and aquatic and backwater land cover to provide habitat for covered species, as well as native fish rearing facilities; and
- periodic managed flooding to maintain overall plant growth and vigor and promote the development of moist soil conditions and flying insect production.

These potential uses of mainstream water are anticipated to occur over the life of the 50-year LCR MSCP.

Generally, the expected mainstream water uses associated with establishment and maintenance of conservation areas could include the use of the annual amounts shown in Table 5-8.

Table 5-8. Expected Mainstream Water Uses Associated with Establishment and Maintenance of Conservation Areas

Land Cover Types	Acres	Estimated Consumptive Use (acre-feet)
Cottonwood-willow	5,940	28,156
Mesquite	1,320	6,323
Marsh	512	2,954
Aquatic	360	1,861
Total	**8,132**	**39,294**

To meet the estimated CU requirement associated with all of the conservation areas, it is assumed that 6.0 afy per acre would be necessary. Consequently, to satisfy the CU requirement of 39,294 afy, approximately 48,800 afy would need to be applied to the conservation areas.

Finally, as was described above, the periodic managed flooding requirement to maintain overall plant growth and vigor and promote the development of moist soil conditions and flying insect production is estimated to be approximately 8,600 afy of additional mainstream water. This water is assumed to be an additional 25 percent of the annual CU of that required to meet the conservation area site total CU needs for cottonwood-willow and mesquite land cover types.

In summary, the total estimated conservation area CU needs, including the managed flooding requirements, is approximately 39,300 afy. This total results in an estimated requirement of approximately 57,400 afy to establish and maintain the 8,132 acres of LCR MSCP conservation areas.

5.6 General Species Conservation Measures

General species conservation measures include impact AMMs and monitoring and research measures (MRMs) that apply to more than one covered or evaluation species. These general measures are not repeated in the species-specific conservation measures described in Section 5.7, "Species-Specific Conservation Measures."

5.6.1 Avoidance and Minimization Measures

This section describes the LCR MSCP conservation measures that will be implemented to avoid and minimize the effects of implementing covered activities and the LCR MSCP on covered species. Each avoidance and minimization conservation measure is provided with a unique four-character alphanumeric code that will assist with monitoring of LCR MSCP Conservation Plan implementation. The three-letter portion of the code designates the conservation measure as an avoidance and minimization measure, and the numeral in the code designates the conservation measure number. In addition to these conservation measures, the BMPs of the state in which a covered activity is implemented will be used to control sedimentation in the vicinity of water bodies during ground-disturbing activities.

AMM1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats. To the extent practicable, establishment and management of LCR MSCP–created habitats will avoid removal of existing cottonwood-willow stands, honey mesquite bosques, marsh, and backwaters to avoid and minimize impacts on habitat they provide for covered species. Temporary disturbance of covered species habitats, however, may be associated with habitat creation and subsequent maintenance activities (e.g., controlled burning in marshes and removal of trees to maintain succession objectives). LCR MSCP conservation measures that could result in such temporary disturbances will, to the extent practicable, be designed

and implemented to avoid or minimize the potential for disturbance. In addition to implementing AMM3 and AMM4 below, these measures could include conducting pre-construction surveys to determine if covered species are present and, if present, implementing habitat establishment and management activities during periods when the species would be least sensitive to those activities; or redesigning the activities to avoid the need to disturb sensitive habitat use areas; staging construction activities away from sensitive habitat use areas; and implementing BMPs to control erosion when implementing ground disturbing activities.

AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh. Impacts on groundwater levels that support covered species habitat at Topock Marsh will be avoided by maintaining water deliveries for maintenance of water levels and existing conditions. At times, flow-related activities could lower river elevations to levels that could disrupt diversion of water from the river to the marsh. Improvements to intake structures that allow water to continue to be diverted or other measures to maintain the water surface elevation will avoid effects on groundwater elevation. Avoidance of effects could be accomplished with the purchase, installation, and operation of two electric pumps sized to the current inflow at the Topock Marsh diversion inlet. The pumps would most likely need to be operated during summer to make up for the lower flow periods.

Implementation of this conservation measure would maintain existing habitat at Topock Marsh for the Yuma clapper rail, southwestern willow flycatcher, Colorado River cotton rat, western least bittern, California black rail, yellow-billed cuckoo, gilded flicker, vermilion flycatcher, Arizona Bell's vireo, and Sonoran yellow warbler. The extent of covered species habitat impacts that will be avoided by maintaining water deliveries to Topock Marsh are presented in Table 4-2. Maintaining water deliveries to Topock Marsh will also maintain razorback sucker and bonytail habitat associated with disconnected backwaters managed for these species.

AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season. To the extent practicable, to avoid and minimize potential impacts on covered bird species, vegetation management activities (e.g., periodic removal of emergent vegetation to maintain canals and drains) associated with implementation of covered activities and the LCR MSCP that could result in disturbance to covered bird species will not be implemented during the breeding season to prevent injury or mortality of eggs and young birds unable to avoid these activities. Table 5-9 describes the breeding period for each of the covered species during which, to the extent practicable, vegetation management activities in each species' habitat will be avoided.

Table 5-9. Covered Bird Species Breeding Periods in the LCR MSCP Planning Area

Covered Species	Breeding Season in the LCR MSCP Planning Area
Yuma clapper rail	March 15 to August 1[1]
Southwestern willow flycatcher	May 10 to August 25[2]
Western least bittern	April 1 to August 1[3]
California black rail	March 15 to August 1[1, 4]
Yellow-billed cuckoo	June 1 to August 15[3]
Elf owl	May 1 to July 20[6]
Gilded flicker	April 1 to August 1[7]
Gila woodpecker	April 1 to September 1[3, 8]
Vermilion flycatcher	March 15 to July 15[3, 9]
Arizona Bell's vireo	April 1 to August 1[3, 10]
Sonoran yellow warbler	April 15 to August 1[3]
Summer tanager	May 15 to September 1[3, 11]

Sources:

1 Eddleman and Conway 1998.
2 Sogge et al. 1997b.
3 Rosenberg et al. 1991.
4 Eddleman et al. 1994.
5 Haug et al. 1993.
6 Henry and Gehlbach 1999.
7 Gilman 1915.
8 Edwards and Schnell 2000.
9 Wolf and Jones 2000.
10 Brown 1993.
11 Robinson 1996.

AMM4—Minimize contaminant loads in runoff and return irrigation flows from LCR MSCP–created habitats to the LCR. LCR MSCP–created habitats that require irrigation to establish and maintain vegetation to provide habitat will be designed and managed to minimize contaminant loads that could return to the LCR as runoff or return-flow. Measures will include vegetation establishment methods that minimize the need for application of herbicides, pesticides, and fertilizers and designing irrigation methods and new irrigation infrastructure to reduce runoff and return-flows to the extent practicable. Use of pesticides is not a covered activity. Pesticides used to establish and maintain LCR MSCP habitats, however, will be applied in accordance with EPA restrictions and, as needed, authorization for their use will be sought under separate permits.

AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area. To the extent practicable, before implementing activities associated with OM&R of hydroelectric generation and transmission facilities, measures will be identified and implemented that are necessary to avoid take of covered species where such activities could otherwise result in take. These measures could include conducting surveys to determine if covered species are present and, if so, deferring the implementation of activities to avoid disturbance during the breeding season; redesigning the activities to avoid the need to disturb covered species habitat use areas; staging of equipment outside of covered species habitats; delineating the limits of vegetation control

activities to ensure that only the vegetation that needs to be removed to maintain infrastructure is removed; stockpiling and disposing of removed vegetation in a manner that minimizes the risk of fire; and implementing BMPs to control erosion when implementing ground disturbing activities.

AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities, and other river management activities. To the extent practicable, before initiating activities involved with river maintenance projects, measures will be identified and implemented that avoid or minimize take of covered species where such activities could otherwise result in take. Such measures could include alternative methods to achieve project goals, timing of activities, pre-activity surveys, and minimizing the area of effect, including offsite direct and indirect effects (e.g., avoiding or minimizing the need to place dredge spoil and discharge lines in covered species habitats; placing dredge spoils in a manner that will not affect covered species habitats).

5.6.2 Monitoring and Research Measures

This section describes the LCR MSCP MRMs that will be implemented to help guide the design and management of created habitats over the term of the LCR MSCP. These MRMs are designed to provide information necessary to adaptively manage implementation of the LCR MSCP Conservation Plan (see Sections 5.11, "Monitoring and Research"). Each monitoring and research conservation measure is provided with a unique four-character alpha-numeric code that will assist with monitoring of LCR MSCP Conservation Plan implementation. The three-letter portion of the code designates the conservation measure as a monitoring and research measure, and the numeral in the code designates the conservation measure number.

MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements. Conduct surveys and research, as appropriate, to collect information necessary to better define the species habitat requirements and to design and manage fully functioning created covered and evaluation species habitats. This conservation measure applies to those species for which comparable measures are not subsumed under species-specific conservation measures (Section 5.7). They are not applicable to species for which habitat would not be created under the LCR MSCP Conservation Plan, such as the desert tortoise, relict leopard frog, humpback chub, and threecorner milkvetch.

This conservation measure applies to the following species:

Yuma clapper rail	California black rail	Arizona Bell's vireo
Southwestern willow flycatcher	Yellow-billed cuckoo	Sonoran yellow warbler
Western red bat	Elf owl	Summer tanager
Western yellow bat	Gilded flicker	California leaf-nosed bat
Desert pocket mouse	Gila woodpecker	Pale Townsend's big-eared bat
Western least bittern	Vermilion flycatcher	

MRM2—Monitor and adaptively manage created covered and evaluation species habitats. Created species habitats will be managed to maintain their functions as species habitat over the term of the LCR MSCP. Created habitat will be monitored and adaptively managed over time to determine the types and frequency of management activities that may be required to maintain created cottonwood-willow, honey mesquite, marsh, and backwater land cover as habitat for covered species. This conservation measure applies to those species for which comparable measures are not subsumed under species-specific conservation measures (Section 5.7). They are not applicable to species for which habitat would not be created under the LCR MSCP Conservation Plan, such as the desert tortoise, relict leopard frog, humpback chub, and threecorner milkvetch.

This conservation measure applies to the following species:

Yuma clapper rail	Western least bittern	Arizona Bell's vireo
Southwestern willow flycatcher	California black rail	Sonoran yellow warbler
Western red bat	Yellow-billed cuckoo	Summer tanager
Western yellow bat	Elf owl	Flannelmouth sucker
Desert pocket mouse	Gilded flicker	MacNeill's sootywing skipper
Colorado River cotton rat	Gila woodpecker	California leaf-nosed bat
Yuma hispid cotton rat	Vermilion flycatcher	Pale Townsend's big-eared bat

MRM3—Conduct research to determine and address the effects of nest site competition with European starlings on reproduction of covered species. Research will be undertaken to determine whether nest site competition with European starlings is a substantial factor limiting the reproductive success of the elf owl, gilded flicker, and Gila woodpecker. If so, experimental programs may be implemented to determine the effectiveness and practicality of controlling starlings.

MRM4—Conduct research to determine and address the effects of brown-headed cowbird nest parasitism on reproduction of covered species. Research will be undertaken to determine whether brown-headed cowbird nest parasitism is a substantial factor limiting the reproductive success of the southwestern willow flycatcher, vermilion flycatcher, Arizona Bell's vireo, Sonoran yellow warbler, and summer tanager in the LCR MSCP planning area. If so, studies will be implemented to identify effective and practical methods for controlling brown-headed cowbirds. If cowbirds are adversely affecting breeding success and effective control measures are developed, a program will be implemented to monitor the effects of cowbirds on nesting success in LCR MSCP–created habitats to determine the need for cowbird control and to implement cowbird control measures in locations where cowbird control is needed to improve reproductive success.

MRM5—Monitor selenium levels in created backwater and marsh land cover types, and study the effect of selenium released as a result of dredging activities. Conduct monitoring of selenium levels in sediment, water, and/or biota present in LCR MSCP created backwater and marsh land cover types. If monitoring results indicate that management of the LCR MSCP conservation areas increases levels of selenium in

created backwaters and marshes or in covered species that use them, the LCR MSCP will undertake research to develop feasible methods to manage the conservation areas in a manner that will eliminate or compensate for the effects of increased selenium levels. If feasible management methods are identified, they will be implemented. This conservation measure will include monitoring the effects of dredging and dredge spoil disposal associated with creating and maintaining backwaters and marshes. If monitoring results indicate that current or future dredging and dredge spoil disposal methods increase selenium levels, the LCR MSCP will only implement methods that will have the least effect on selenium levels. A study will also be conducted to look at the effects of potential releases of selenium from dredging in general.

5.6.3 Conservation Area Management Measures

This section describes the LCR MSCP conservation area management measures (CMMs) that will be implemented to maintain the intended functions and values of created covered species habitats over the term of the LCR MSCP. Each CMM is provided with a unique four-character alphanumeric code that will assist with monitoring of LCR MSCP Conservation Plan implementation. The three-letter portion of the code designates the conservation measure as a conservation area management measure, and the numeral in the code designates the conservation measure number.

CMM1—Reduce risk of loss of created habitat to wildfire. Management of LCR MSCP conservation areas will include contributing to and integrating with local, state, and Federal agency fire management plans. Conservation areas will be designed to contain wildfire and facilitate rapid response to suppress fires (e.g., fire management plans will be an element of each conservation area management plan).

CMM2—Replace created habitat affected by wildfire. In the event of created-habitat degradation or loss as a result of wildfire, land management and habitat creation measures to support the reestablishment of native vegetation will be identified and implemented.

5.7 Species-Specific Conservation Measures

This section describes the species-specific LCR MSCP conservation measures, in addition to the general conservation measures described in Section 5.6, “General Species Conservation Measures,” that will be implemented to avoid, minimize, and fully mitigate the effects of implementing covered activities and contribute to the recovery of listed covered species/reduce the likelihood of future listing of nonlisted covered species. Each species conservation measure is provided with a unique five-character alpha-numeric code that will assist with monitoring of LCR MSCP Conservation Plan implementation. The four-letter portion of the code designates the covered species, and the numeral in the code designates the conservation measure number for the species.

Detailed information on the ecology and status of each covered species used to support this plan is provided in Appendix I. Table 5-10 presents a summary of impacts of

implementing covered activities and the LCR MSCP, the estimated levels of take, conservation measures, and expected outcomes for each covered species. Impacts of implementing covered activities and the LCR MSCP on the extent of covered species habitats and the extent of habitat that will be created under the LCR MSCP are presented in Table 5-11.

5.7.1 Yuma Clapper Rail

5.7.1.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 173 acres of Yuma clapper rail habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 70 acres of habitat. Some additional limited and low value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.1.2 Conservation Measures

CLRA1—Create 512 acres of Yuma clapper rail habitat. Create and manage 512 acres of marsh to provide Yuma clapper rail habitat (Figure 5-2). This created habitat will also provide habitat for the western least bittern and the California black rail (see conservation measures LEBI1 and BLRA1). Habitat will be created in patches as large as possible but will not be created in patches smaller than 5 acres. Smaller patches are likely to support isolated nesting pairs and be within the range of habitat patch sizes used by the species for foraging and dispersal. Larger patches would be expected to support multiple nesting pairs. Additional Yuma clapper rail habitat may be provided by marsh vegetation that becomes established along margins of the 360 acres of backwaters that will be created in Reaches 3–6. These small patches of habitat would provide cover for dispersing rails, thereby facilitating linkages between existing breeding populations and the colonization of created habitats.

Yuma clapper rail habitat will be created and maintained as described in Section 5.4.3.3. Marshes created to provide Yuma clapper rail habitat will be designed and managed to provide an integrated mosaic of wetland vegetation types, water depths, and open water areas. Within this mosaic of marsh conditions, Yuma clapper rail habitat will generally be provided by patches of bulrush and cattails interspersed with small patches of open water with water levels maintained at depths appropriate for this species (no more than 12 inches).

CLRA2—Maintain existing important Yuma clapper rail habitat areas. The Applicants, under agreements with cooperating land management agencies, will provide funding to those agencies to maintain a portion of existing Yuma clapper rail habitat within the LCR MSCP planning area (Section 5.4.2). Maintaining important existing habitat areas is necessary to ensure the continued existence of Yuma clapper rails in the

Table 5-10. Summary of Impacts and Conservation Measures to Avoid, Minimize, and Compensate Impacts of Implementing Covered Activities and the LCR MSCP Conservation Plan

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
Threatened and Endangered Species			
Yuma clapper rail	▪ Loss of up to 133 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 70 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 10 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat restoration and habitat management activities ▪ Potential periodic removal of up to 30 acres of emergent vegetation that could provide habitat along 244 miles of drains ▪ Potential for disturbance of up to 512 acres of existing degraded or former marsh that may provide low habitat value associated with converting it to fully functioning marsh that provides high value habitat ▪ Potential for removal of some limited and low value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) as a result of creating covered species habitats with implementation of the LCR MSCP Conservation Plan[b] ▪ Harassment of individuals associated with operation of equipment and other activities	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM5—Monitor selenium levels in created backwater and marsh land cover types, and study the effect of selenium released as a result of dredging activities CLRA1—Create 512 acres of Yuma clapper rail habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire CLRA2—Maintain existing important Yuma clapper rail habitat areas	Implementation of the conservation measures achieves the LCR MSCP goals to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Yuma clapper rail, and to contribute to its recovery. Implementation of these measures will contribute to recovery by increasing the amount of new nesting habitat by 269 acres over the number of impacted acres.

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP		
Southwestern willow flycatcher	▪ Loss of up to 1,784 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 59 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 10 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat restoration and habitat management activities ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM4—Conduct research to determine and address the effects of brown-headed cowbird nest parasitism on reproduction of covered species WIFL1—Create 4,050 acres of Southwestern willow flycatcher habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire WIFL2—Maintain existing important habitat areas	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the southwestern willow flycatcher, and contribute to its recovery. Implementation of these measures will contribute to recovery by increasing the amount of new breeding habitat by 2,197 acres in addition to replacing the extent of impacted habitat. The conservation measures will also contribute to the objectives of the Southwestern Willow Flycatcher Recovery Plan (U.S. Fish and Wildlife Service 2002b).

Table 5-10. Continued

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
Desert tortoise (Mojave population)	▪ Loss of up to 192 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for direct mortality of individuals associated with operation of vehicles and other equipment with implementation of non-flow-related covered activities and implementation of the LCR MSCP Conservation Plan over the term of the LCR MSCP	AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area DETO1—Acquire and protect 230 acres of existing unprotected occupied habitat DETO2—Avoid impacts on individuals and their burrows	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Mohave population of desert tortoises.
Bonytail	▪ Loss of up to 399 acres of habitat associated with implementation of flow-related covered activities ▪ Potential temporary disturbance of habitat associated with the creation of habitat and habitat management activities. ▪ Potential for entrainment of individuals at diversions over the term of the LCR MSCP ▪ Potential for direct mortality of individuals as a result of stranding over the term of the LCR MSCP	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM4—Minimize contaminant loads in runoff and return irrigation flows from LCR MSCP created habitats to the LCR AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM5—Monitor selenium levels in created backwater and marsh land cover types, and study the effect of selenium released as a result of dredging activities BONY1—Coordinate bonytail conservation efforts with the USFWS and recovery programs for endangered fish species in the Lower Basin BONY2—Create 360 acres of bonytail habitat BONY3—Augment bonytail populations BONY4—Evaluate and develop, if necessary, additional bonytail rearing capacity BONY5—Conduct monitoring and research, and adaptively manage bonytail augmentations and created habitat	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the bonytail, and contribute to its recovery. Implementation of these measures will contribute to attainment of the recovery goals established for the species (U.S. Fish and Wildlife Service 2002c).

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
Humpback chub	▪ Periodic loss of up to 62 miles of transitory Colorado River channel habitat that may be present in Lake Mead when the reservoir is below full pool elevation and lost when reservoir elevations are raised	HUCH1—Provide funding to support existing humpback chub conservation programs	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the humpback chub, and contribute to its recovery.
Razorback sucker	▪ Loss of up to 399 acres of habitat associated with implementation of flow-related covered activities ▪ Potential for periodic loss of razorback sucker spawning habitat in Lake Mead (Reach 1) with implementation of flow-related covered activities ▪ Potential temporary disturbance of habitat associated with the creation of habitat and habitat management activities. ▪ Potential for entrainment of individuals at diversions over the term of the LCR MSCP ▪ Potential for direct mortality of individuals as a result of stranding over the term of the LCR MSCP	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM4—Minimize contaminant loads in runoff and return irrigation flows from LCR MSCP created habitats to the LCR AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM5—Monitor selenium levels in created backwater and marsh land cover types, and study the effect of selenium released as a result of dredging activities RASU1—Coordinate razorback sucker conservation efforts with USFWS and recovery programs for endangered fish species in the Lower Basin Implementation Program RASU2—Create 360 acres of razorback sucker habitat RASU3—Augment razorback populations RASU4—Develop additional razorback sucker rearing capacity RASU5—Support ongoing razorback conservation efforts at Lake Mohave RASU6—Conduct monitoring and research, and adaptively manage	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the razorback sucker, and contribute to its recovery. Implementation of these measures will contribute to attainment of the recovery goals established for the species (U.S. Fish and Wildlife Service 2002e).

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
		razorback sucker augmentations and created habitat RASU7—Provide funding and support for continuation of the Reclamation/SNWA ongoing Lake Mead razorback sucker studies RASU8—Continue razorback conservation measures identified in the ISC/SIA BO	
Other Covered Species			
Western red bat (roosting habitat)	▪ Loss of up to 161 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 604 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for likely small, unmeasurable, effects on the production and abundance of insect prey associated with implementation of covered activities	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats WRBA1—Conduct surveys to determine species distribution of the western red bat WRBA2— Create 765 acres of western red bat roosting habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the western red bat.

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
Western yellow bat (roosting habitat)	▪ Loss of up to 161 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 604 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for likely small, unmeasurable, effects on the production and abundance of insect prey associated with implementation of covered activities	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats WYBA1—Conduct surveys to determine species distribution of the western yellow bat WYBA2—Avoid removal of western yellow bat roosts trees WYBA3— Create 765 acres of western yellow bat roosting habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the western yellow bat.
Desert pocket mouse	▪ Potential temporary or permanent disturbance or loss of habitat associated with the restoration of habitat and habitat management activities ▪ Potential temporary disturbance of habitat associated with the creation of LCR MSCP habitats and habitat management activities[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP	AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area DPMO1—Conduct surveys to locate desert pocket mouse habitat	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the desert pocket mouse.

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	Conservation Plan ▪ Potential for direct mortality of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP		
Colorado River cotton rat	▪ Loss of up to 59 acres of habitat associated with implementation of flow-related covered activities ▪ Loss of up to 3 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 5 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, restoration of habitat and habitat management activities ▪ Potential for disturbance of up to 125 acres of existing degraded or former marsh that may provide low habitat value associated with converting it to fully functioning marsh that provides high value habitat ▪ Potential for removal of some limited and low value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) as a result of creating covered species habitats with implementation of the LCR MSCP Conservation Plan[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM5—Monitor selenium levels in created backwater and marsh land cover types, and study the effect of selenium released as a result of dredging activities CRCR1—Conduct research to better define Colorado River cotton rat habitat requirements CRCR2—Create 125 acres of Colorado River cotton rat habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Colorado River cotton rat.

Table 5-10. Continued

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
Yuma hispid cotton rat	▪ Loss of up to 71 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 5 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat restoration and habitat management activities ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM2—Monitor and adaptively manage created covered and evaluation species habitats YHCR1—Conduct research to better define Yuma hispid cotton rat habitat requirements YHCR2—Create 76 acres of Yuma hispid cotton rat habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Yuma hispid cotton rat.
Western least bittern	▪ Loss of up to 133 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 70 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 10 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the western least bittern, and reduce the likelihood of future federal listing of the species. Implementation of these measures will benefit

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	restoration and habitat management activities ▪ Potential periodic removal of up to 30 acres of emergent vegetation that could provide habitat along 244 miles of drains ▪ Potential for disturbance of up to 512 acres of existing degraded or former marsh that may provide low habitat value associated with converting it to fully functioning marsh that provides high value habitat ▪ Potential for removal of some limited and low value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) as a result of creating covered species habitats with implementation of the LCR MSCP Conservation Plan[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM5—Monitor selenium levels in created backwater and marsh land cover types, and study the effect of selenium released as a result of dredging activities LEBI1—Create 512 acres of western least bittern habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	the western least bittern by increasing the amount of new habitat in the LCR MSCP planning area by 269 acres in addition to replacing the extent of impacted habitat.
California black rail	▪ Loss of up to 37 acres of habitat associated with implementation of flow-related covered activities ▪ Loss of up to 31 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 5 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat restoration and habitat management activities	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the California black rail, and reduce the likelihood of future federal listing of the

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	▪ Potential periodic removal of up to 30 acres of emergent vegetation that could provide habitat along 244 miles of drains ▪ Potential for disturbance of up to 130 acres of existing degraded or former marsh that may provide low habitat value associated with converting it to fully functioning marsh that provides high value habitat ▪ Potential for removal of some limited and low value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) as a result of creating covered species habitats with implementation of the LCR MSCP Conservation Plan[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM5—Monitor selenium levels in created backwater and marsh land cover types, and study the effect of selenium released as a result of dredging activities BLRA1—Create 130 acres of California black rail habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire BLRA2—Maintain existing important California black rail habitat areas	species. Implementation of these measures will benefit the California black rail by increasing the amount of new habitat in the LCR MSCP planning area by 27 acres in addition to replacing the extent of impacted habitat.
Yellow-billed cuckoo	▪ Loss of up to 1,425 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 99 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 10 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the yellow-billed cuckoo, and reduce the likelihood of future federal listing of the species. Implementation of these measures will benefit

Table 5-10. Continued

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	restoration and habitat management activities ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats YBCU1—Create 4,050 acres of yellow-billed cuckoo habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire YBCU2—Maintain existing important yellow-billed cuckoo habitat areas	the yellow-billed cuckoo by increasing the amount of new habitat in the LCR MSCP planning area by 2,516 acres in addition to replacing the extent of impacted habitat.
Elf owl	▪ Loss of up to 161 acres of habitat associated with implementation of flow-related covered activities ▪ Loss of up to 590 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM3—Conduct research to determine and address the effects of nest site competition with European starlings on reproduction of covered species	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the elf owl, and reduce the likelihood of future federal listing of the species. Implementation of these measures will benefit the elf owl by increasing the amount of new habitat in the LCR MSCP planning area by 1,033 acres in addition to replacing the extent of impacted habitat.

Table 5-10. Continued

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	implementation of non-flow-related covered activities over the term of the LCR MSCP	ELOW1—Create 1,784 acres of elf owl habitat ELOW2—Install elf owl nest boxes CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	
Gilded flicker	▪ Loss of up to 1,425 acres of habitat associated with implementation of flow-related covered activities ▪ Loss of up to 99 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 10 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat restoration and habitat management activities ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM3—Conduct research to determine and address the effects of nest site competition with European starlings on reproduction of covered species GIFL1—Create 4,050 acres of gilded flicker habitat GIFL2—Install artificial snags to provide gilded flicker nest sites CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the gilded flicker, and reduce the likelihood of future federal listing of the species. Implementation of these measures will benefit the gilded flicker by increasing the amount of new habitat in the LCR MSCP planning area by 2,516 acres in addition to replacing the extent of impacted habitat.

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
Gila woodpecker	▪ Loss of up to 819 acres of habitat associated with implementation of flow-related covered activities ▪ Loss of up to 26 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 10 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat restoration and habitat management activities ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM3—Conduct research to determine and address the effects of nest site competition with European starlings on reproduction of covered species GIWO1—Create 1,702 acres of Gila woodpecker habitat GIWO2—Install artificial snags to provide Gila woodpecker nest sites CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Gila woodpecker, and reduce the likelihood of future federal listing of the species. Implementation of these measures will benefit the gilded flicker by increasing the amount of new habitat in the LCR MSCP planning area by 847 acres in addition to replacing the extent of impacted habitat.
Vermilion flycatcher	▪ Loss of up to 1,890 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 714 acres of habitat associated with implementation of federal non-flow-	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the vermilion flycatcher, and reduce the likelihood of

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	related covered activities[a] ▪ Potential for loss of up to 10 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat restoration and habitat management activities ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM4—Conduct research to determine and address the effects of brown-headed cowbird nest parasitism on reproduction of covered species VEFL1—Create 5,208 acres of vermilion flycatcher habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	future federal listing of the species. Implementation of these measures will benefit the vermilion flycatcher by increasing the amount of new habitat in the LCR MSCP planning area by 2,594 acres in addition to replacing the extent of impacted habitat.
Arizona Bell's vireo	▪ Loss of up to 1,654 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 1,309 acres of habitat associated with implementation of federal non-flow-related covered activities[a,c] ▪ Potential for loss of up to 20 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat restoration and habitat management activities	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Arizona Bell's vireo.

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM4—Conduct research to determine and address the effects of brown-headed cowbird nest parasitism on reproduction of covered species BEVI1—Create 2,983 acres of Arizona Bell's vireo habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	
Sonoran yellow warbler	▪ Loss of up to 2,929 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 183 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for loss of up to 10 acres of degraded, low-value habitat associated with non-Federal, non-flow-related, habitat restoration and habitat management activities ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b]	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM2—Avoid impacts of flow-related covered activities on covered species habitats at Topock Marsh AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM4—Conduct research to determine and address the effects of brown-headed cowbird nest parasitism on reproduction of covered species	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Sonoran yellow warbler, and reduce the likelihood of future federal listing of the species. Implementation of these measures will benefit the Sonoran yellow warbler by increasing the amount of new habitat in the LCR MSCP planning area by 928 acres in addition to replacing the extent of impacted habitat.

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	YWAR1—Create 4,050 acres of Sonoran yellow warbler habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	
Summer tanager	▪ Loss of up to 161 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic establishment and loss of habitat within the full pool elevation of Lake Mead as a result of fluctuations in reservoir elevation ▪ Loss of up to 14 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Potential for incidental take of individuals from activities that create covered species habitats in land cover types not considered to be habitat for the species, but where some transitory or minor use of the land cover type does occur[b] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of a small number of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM3—To the extent practicable, avoid and minimize disturbance of covered bird species during the breeding season AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM4—Conduct research to determine and address the effects of brown-headed cowbird nest parasitism on reproduction of covered species SUTA1—Create 602 acres of summer tanager habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the summer tanager, and reduce the likelihood of future federal listing of the species. Implementation of these measures will benefit the summer tanager by increasing the amount of new habitat in the LCR MSCP planning area by 427 acres in addition to replacing the extent of impacted habitat.

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
Flat-tailed horned lizard	▪ Loss of up to 128 acres of habitat associated with implementation of federal non-flow-related covered activities[a] ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of individuals associated with implementation of non-flow-related covered activities and the LCR MSCP over the term of the LCR MSCP	AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area FTHL1—Acquire and protect 230 acres of existing unprotected occupied flat-tailed horned lizard habitat FTHL2—Implement conservation measures to avoid or minimize take of flat-tailed horned lizard	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the flat-tailed horned lizard.
Relict leopard frog	▪ Potential temporary disturbance of habitat associated with the creation of habitat and habitat management activities. ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	RLFR1—Provide funding to support existing relict leopard frog conservation programs	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the relict leopard frog, and reduce the likelihood of future federal listing of the species.
Flannelmouth sucker	▪ Loss of up to 85 acres of habitat associated with implementation of flow-related covered activities ▪ Periodic loss of transitory Colorado River and Virgin River channel habitat that may be present in Lake Mead when the reservoir is below full pool elevation and lost when reservoir elevations are raised ▪ Potential temporary disturbance of habitat associated with the creation of habitat and habitat management activities.	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM4—Minimize contaminant loads in runoff and return irrigation flows from LCR MSCP created habitats to the LCR AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area AMM6—Avoid or minimize impacts on covered species habitats during dredging, bank stabilization activities and other river management activities	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the flannelmouth sucker, and reduce the likelihood of future federal listing of the species.

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
	▪ Potential for entrainment of individuals at diversions over the term of the LCR MSCP ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	MRM2—Monitor and adaptively manage created covered and evaluation species habitats MRM5—Monitor selenium levels in created backwater and marsh land cover types, and study the effect of selenium released as a result of dredging activities FLSU1—Create 85 acres of flannelmouth sucker habitat FLSU2—Provide funding to support existing flannelmouth sucker conservation programs FLSU3—Assess flannelmouth sucker management needs and develop management strategies	
MacNeill's sootywing skipper	▪ Loss of up to 172 acres of habitat associated with implementation of flow-related covered activities ▪ Loss of up to 50 acres of habitat associated with implementation of Federal non-flow-related covered activities[a] ▪ Potential disturbance of or loss of a small, unquantifiable amount of habitat associated with the creation of habitat and habitat management activities. ▪ Harassment of individuals associated with operation of equipment and other activities related to implementing non-flow-related covered activities and the LCR MSCP Conservation Plan ▪ Potential for direct mortality of individuals associated with implementation of non-flow-related covered activities over the term of the LCR MSCP	AMM 1—To the extent practicable, avoid and minimize impacts of implementing the LCR MSCP on existing covered species habitats AMM5—Avoid impacts of operation, maintenance, and replacement of hydroelectric generation and transmission facilities on covered species in the LCR MSCP planning area MRM2—Monitor and adaptively manage created covered and evaluation species habitats MNSW1—Conduct surveys and research to locate MacNeill's sootywing skipper habitat and to better define its habitat requirements MNSW2—Create at least 222 acres of MacNeill's sootywing skipper habitat CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the MacNeill's sootywing skipper.
Sticky buckwheat	▪ Potential for direct mortality of individuals associated with implementation of flow-related covered activities over the term of the LCR MSCP	STBU1—Provide funding to support existing sticky buckwheat conservation programs	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
			effects of covered activities and LCR MSCP implementation on the sticky buckwheat, and reduce the likelihood of future federal listing of the species.
Threecorner milkvetch	▪ Potential for direct mortality of individuals associated with implementation of flow-related covered activities over the term of the LCR MSCP	THMI1—Provide funding to support existing threecorner milkvetch conservation programs	Implementation of the conservation measures achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the threecorner milkvetch, and reduce the likelihood of future federal listing of the species.
Evaluation Species			
California leaf-nosed bat (roosting habitat)	▪ Potential for likely small, unmeasurable, effects on the production and abundance of insect prey associated with implementation of flow-related activities	MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats CLNB1—Conduct surveys to locate California leaf-nosed bat roost sites CLNB2—Create covered species habitat near California leaf-nosed bat roost sites CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures will fully mitigate flow-related impacts, if any, on the diversity and production of insects. In addition, implementation of survey and research conservation measures will provide important information for use in developing future conservation efforts for this species.

Table 5-10. Continued

Species	Impacts and Estimated Level of Take	Conservation Measures to Avoid, Minimize, and Mitigate Impacts	Summary of Expected Outcomes
Pale Townsend's big-eared bat (roosting habitat)	▪ Potential for likely small, unmeasurable, effects on the production and abundance of insect prey associated with implementation of flow-related activities	MRM1—Conduct surveys and research to better identify covered and evaluation species habitat requirements MRM2—Monitor and adaptively manage created covered and evaluation species habitats PTBB1—Conduct surveys to locate pale Townsend's big-eared bat roost sites PTBB2— Create covered species habitat near pale Townsend's big-eared bat roost sites CMM1—Reduce risk of loss of created habitat to wildfire CMM2—Replace created habitat affected by wildfire	Implementation of the conservation measures will fully mitigate flow-related impacts, if any, on the diversity and production of insects. In addition, implementation of survey and research conservation measures will provide important information for use in developing future conservation efforts for this species.
Colorado River toad	▪ No impacts expected	CRTO1—Conduct research to better define the distribution, habitat requirements, and factors that are limiting the distribution of the Colorado River toad CRTO2—Protect existing unprotected occupied Colorado River toad habitat CRTO3—Conduct research to determine feasibility of establishing the Colorado River toad in unoccupied habitat	Implementation of the conservation measures will provide information necessary for successful management to maintain and increase the abundance of the Colorado River toad throughout its range.
Lowland leopard frog	▪ No impacts expected	LLFR1— Conduct research to better define the distribution, habitat requirements, and factors that are limiting the distribution of the lowland leopard frog LLFR2—Protect existing unprotected occupied lowland leopard frog habitat LLFR3— Conduct research to determine feasibility of establishing the lowland leopard frog in unoccupied habitat	Implementation of the conservation measures would provide information necessary for successful management to maintain and increase the abundance of lowland leopard frogs throughout its range.

Note:

[a] The estimated effects on covered species habitats that will result from implementation of the federal non-flow-related covered activities addressed in the LCR MSCP BA. The amount of land cover types to be created to provide covered species habitats described in Chapter 5 "Conservation Plan" includes the creation of sufficient land cover to provide covered species habitat to mitigate both the impacts of implementing the LCR MSCP HCP and the federal non-flow-related activities on covered species habitats.

[b] The LCR MSCP currently estimates that about two-thirds of LCR MSCP created habitat would be created on agricultural lands (5,045 acres), including associated infrastructure (estimated to be 1 percent of all habitat created, or 81 acres). Agricultural lands provide little or no habitat value for covered and evaluation species.

The LCR MSCP impact assessment also assumes that up to 512 acres of existing degraded or former marsh that may provide low-value habitat could be converted to create fully functioning marsh that provides high-value Yuma clapper rail, western least bittern, California black rail, and Colorado River cotton rat habitat. Up to 360 acres of existing degraded or former backwaters could also be converted to create fully functioning backwaters that provides high-value habitat for the bonytail, razorback sucker, and flannelmouth sucker. Conversion of existing degraded or former marsh and backwaters to create habitat for these species, however, will not result in a loss of existing habitat.

The remainder of LCR MSCP habitat (currently estimated to be 2,377 acres) would be created on additional lands that may support some transitory or minor level of use (e.g., saltcedar and saltcedar-dominated land cover types) by individuals of one or more covered species, but are not considered to be habitat. These land cover types would be lost and replaced with habitats designed to be of higher value for the covered species. Implementation of the avoidance and minimization measures described in Section 5.6.1, "Avoidance and Minimization Measures," however, will reduce the likelihood of incidental take of covered species that could be associated with removal of these land cover types.

[c] Includes 610 acres of honey mesquite IV that provides Arizona Bell's vireo habitat that could be converted to agricultural uses and that are covered under the LCR MSCP. Up to an additional 3,832 acres of honey mesquite IV that provides habitat could be removed by Federal non-flow-related activities, however, these activities and resultant impacts are not covered under the LCR MSCP.

Table 5-11. Comparison of Species-Specific Habitat Impacts to Created LCR MSCP Habitat

Covered Species	Impacts of Federal and Non-Federal Flow-Related Covered Activities[a]	Impacts of Federal and Non-Federal Non-Flow-Related Covered Activities[a,b]	Total Impacts	LCR MSCP Created Habitat
Threatened and Endangered Species				
Yuma clapper rail	133	110	243	512
Southwestern willow flycatcher	1,784	69	1,853	4,050
Desert tortoise (Mojave population)	0	192	192	0[c]
Bonytail	399	0	399	360[d]
Humpback chub	ND[e]	0	ND[e]	ND[e]
Razorback sucker	399	0	399	360[d]
Other Covered Species				
Western red bat (roosting habitat)	161	604	765	765
Western yellow bat (roosting habitat)	161	604	765	765
Desert pocket mouse	0	0	0	0
Colorado River cotton rat	59	8	67	125
Yuma hispid cotton rat	0	76	76	76
Western least bittern	133	110	243	512
California black rail	37	66	103	130
Yellow-billed cuckoo	1,425	109	1,534	4,050
Elf owl	161	590	751	1,784
Gilded flicker	1,425	109	1,534	4,050
Gila woodpecker	819	36	855	1,702
Vermilion flycatcher	1,890	724	2,614	5,208
Arizona Bell's vireo	1,654	1,329[f]	2,983[f]	2,983
Sonoran yellow warbler	2,929	193	3,122	4,050
Summer tanager	161	14	175	602
Flat-tailed horned lizard	0	128	128	0[g]
Relict leopard frog	0[h]	0[h]	0[h]	0
Flannelmouth sucker	85	0	85	85
MacNeill's sootywing skipper	172	50	222	222
Sticky buckwheat	ND[i]	0	ND[i]	ND[i]
Threecorner milkvetch	ND[i]	0	ND[i]	ND[i]
Evaluation Species				
California leaf-nosed bat (roosting habitat)	0	0	0	0
Pale Townsend's big-eared bat (roosting habitat)	0	0	0	0
Colorado River toad	0	0	0	0
Lowland leopard frog	0	0	0	0

Note: LCR MSCP conservation measures to create habitat for covered species will avoid removal of cottonwood-willow, honey mesquite, marsh, and backwater land cover types that provide habitat for covered species, and, therefore, impacts of implementing the LCR MSCP conservation measures are not shown in this table. The LCR MSCP currently estimates that about two-thirds of LCR MSCP created habitat would be created on agricultural lands (5,045 acres), including associated infrastructure (estimated to be 1percent of all habitat created, or 81 acres). Agricultural lands provide little or no habitat value for covered and evaluation species.

The LCR MSCP impact assessment also assumes that up to 512 acres of existing degraded or former marsh that may provide low-value habitat could be converted to create fully functioning marsh that provides high-value Yuma clapper rail, western least bittern, California black rail, and Colorado River cotton rat habitat. Up to 360 acres of existing degraded or former backwaters could also be converted to create fully functioning backwaters that provides high-value habitat for the bonytail, razorback sucker, and flannelmouth sucker. Conversion of existing degraded or former marsh and backwaters to create habitat for these species, however, will not result in a loss of existing habitat.

The remainder of LCR MSCP habitat (currently estimated to be 2,377 acres) would be created on additional lands that may support some transitory or minor level of use (e.g., saltcedar and saltcedar-dominated land cover types) by individuals of one or more covered species, but are not considered to be habitat . These land cover types would be lost and replaced with habitats designed to be of higher value for the covered species. Implementation of the avoidance and minimization measures described in Section 5.6.1, "Avoidance and Minimization Measures," however, will reduce the likelihood of incidental take of covered species that could be associated with removal of these land cover types.

[a] Impacts of non-Federal non-flow-related covered activities are derived from Table 4-5.

[b] The estimated effects on covered species habitats that will result from implementation of the Federal non-flow-related covered activities are addressed in the LCR MSCP BA. The amount of land cover types to be created or protected to provide covered species habitats described in Table 5-5 includes the creation or protection of sufficient land cover to provide covered species habitat to mitigate both the impacts of implementing the LCR MSCP HCP and the Federal non-flow-related activities on covered species habitats.

[c] Net loss in habitat is fully mitigated by protecting 230 acres of desert tortoise habitat in accordance with mitigation requirements in the document entitled "Compensation for Desert Tortoise" (Desert Tortoise Compensation Team 1991).

[d] The effects of the loss of 399 acres of backwater on this species is fully mitigated by both creating 360 acres of backwater that will be managed to provide greater habitat values for this species and by stocking juvenile fish to substantially augment the existing population over the term of the LCR MSCP (Section 5.7.4, "Bonytail," and Section 5.7.6, "Razorback Sucker").

[e] ND = Not determined. Acres of potentially affected habitat are not calculated. Changes in reservoir elevations associated with implementation of flow-related covered activities, however, could result in the establishment of up to 62 miles of transitory Colorado River channel when the reservoir pool is maintained at lower elevations that could be occupied by humpback chub and subsequently lost when reservoir elevations rise.

[f] Includes 610 acres of honey mesquite IV that provides Arizona Bell's vireo habitat that could be converted to agricultural uses and that are covered under the LCR MSCP. Up to an additional 3,832 acres of honey mesquite IV that provides habitat could be removed by Federal non-flow-related activities, however, these activities and resultant impacts are not covered under the LCR MSCP.

[g] Net loss in habitat is fully mitigated by protecting 230 acres of flat-tailed horned lizard habitat in accordance with mitigation requirements in the Flat-Tailed Horned Lizard Rangewide Management Strategy (Flat-tailed Horned Lizard Interagency Coordinating Committee 2003).

[h] Implementation of covered activities will not result in removal of this species' habitat but could result in temporary disturbance of habitat or affect movement of individuals.

[i] ND = Not determined. Acres of potentially affected habitat are not calculated. Changes in Lake Mead reservoir elevations associated with implementation of flow-related covered activities, however, would result in periodic loss of habitat that is exposed along the Lake Mead shoreline when reservoir elevations are low and then is subsequently inundated when reservoir elevations rise.

LCR MSCP planning area, provide for the production of individuals that could disperse to and nest in LCR MSCP–created habitat, and support future recovery of the species. Habitat maintenance would likely be undertaken in conjunction with the maintenance of existing California black rail habitat.

5.7.1.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including maintenance of existing important habitat areas and creation of 512 acres of habitat, achieves the LCR MSCP goals to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Yuma clapper rail, and to contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. Implementation of the conservation measures will also contribute to recovery by increasing the amount of new breeding habitat by 269 acres, in addition to replacing the extent of affected habitat.

5.7.2 Southwestern Willow Flycatcher

5.7.2.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 1,794 acres of southwestern willow flycatcher habitat and harassment of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 59 acres of habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.2.2 Conservation Measures

WIFL1—Create 4,050 acres of southwestern willow flycatcher habitat. Of the 5,940 acres of created cottonwood-willow, at least 4,050 acres will be designed and created to provide habitat for this species. Created cottonwood-willow will be designed and managed to support cottonwood-willow types I–IV that provide breeding habitat for this species. The created cottonwood-willow would also function as migration habitat for birds that migrate along the LCR. A total of 2,700 acres of created habitat will be designed and managed to provide habitat for both the southwestern willow flycatcher and yellow-billed cuckoo. To provide habitat for both species, created habitat will need to be composed of cottonwood-willow types I–IV, include moist soils for flying insect production, and be in large habitat blocks (at least 25 acres but preferably up to 200 or more acres). The remaining 1,350 acres of the 4,050 acres of created habitat will also be

composed of cottonwood-willow types I–IV and will include moist soils, but patches of this habitat may be smaller if site constraints limit the construction of larger habitat patches.

Of the 1,350 acres of habitat to be created specifically for the yellow-billed cuckoo (Section 5.7.14), patches that provide surface water or moist surface soil conditions during the breeding season will also support habitat for the southwestern willow flycatcher.

In addition to the spatial replacement of affected habitat, the quality of created habitat will be substantially greater than the affected habitat. Affected southwestern willow flycatcher habitat is dominated by dense stands of saltcedar that support little vegetative diversity relative to the cottonwood-willow land cover that will be created and managed as flycatcher breeding habitat. Cottonwood-willow land cover created to provide southwestern willow flycatcher habitat will be designed and managed to be dominated by native riparian trees (i.e., cottonwood and willow trees), support flying insect production used as food by the flycatcher, support a diversity of plant species, provide a dense multilayered canopy, support multiple seral stages, and provide substantial areas of edge habitat. Created habitat, thus, will be similar to the condition of the species' native habitat that was historically present along the LCR.

The relative suitability and carrying capacity of saltcedar and cottonwood-willow habitats for nesting southwestern willow flycatchers are difficult to measure under current conditions because saltcedar now dominates most riparian areas along the LCR. Based on historical accounts, however, cottonwood-willow forests of the LCR once supported a high diversity and density of nesting birds, including willow flycatchers (Grinnell 1914; Garrett and Dunn 1981; Rosenberg et al. 1991). Thus, it is reasonable to assume that the successful replacement of the current saltcedar-dominated habitats by the species' historical, native habitat would provide highly favorable conditions for long-term maintenance and enhancement of southwestern willow flycatcher populations on the LCR.

To ensure that high quality and fully functioning southwestern willow flycatcher breeding habitat is created, the following design and management criteria, subject to adjustment through the LCR MSCP adaptive management process, will be applied to created cottonwood-willow land cover dedicated as replacement southwestern willow flycatcher habitat:

- Southwestern willow flycatcher habitat will be created in patches of at least 10 acres, with an objective of creating larger patches of habitat.
- Created-habitat patches will be close to each other or existing tracts of riparian forest that provide southwestern willow flycatcher habitat in a manner that will maximize continuity with other riparian habitats.
- Designs of created habitats will emphasize creation of nesting habitat within 200 feet of standing or slow-moving water or moist surface soils (suitable insect-productive foraging habitats) and will include creation of suitable habitat edges that are preferred by this species.

- Created habitat will include provisions for supporting moist surface soils and standing or slow-moving water required by the species within their territories during the breeding season (may extend from late April to August along the LCR). Maintaining these conditions could involve creation of canals and shallow swales that permanently or seasonally maintain surface water or moist surface soil conditions. Because the actual period that moist soils or ponded or slow-moving water conditions must be present to support successful reproduction is not well understood, watering of created habitat will be managed adaptively to determine periods when water must be present to support flycatcher reproduction.
- Canals and shallow swales may need to be created to dissect blocks of created cottonwood-willow that will be wide enough (estimated to be at least 25 feet) to create interior forest-edge conditions necessary to support southwestern willow flycatcher habitat, create the microrelief and soil moisture conditions necessary to support a diversity of understory plant species, and supply irrigation water.
- Created habitat will be designed and actively managed to support a vigorous plant community that will support multiple layers, seral stages, and age cohorts of trees.
- Mounds and depressions, to the extent necessary, will be created in habitat created on conservation areas to establish some topographic diversity that will also provide habitat diversity by increasing plant and insect prey species diversity.

WIFL2—Maintain existing important habitat areas. The Applicants, under agreements with cooperating land management agencies, will provide funding to those agencies to maintain a portion of existing southwestern willow flycatcher habitat within the LCR MSCP planning area (Section 5.4.2). Maintaining important existing habitat areas is necessary to ensure the continued existence of the southwestern willow flycatcher in the LCR MSCP planning area, provide for the production of individuals that could disperse to and nest in LCR MSCP–created habitats, and support future recovery of the species.

5.7.2.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including maintenance of existing important habitat areas and creation of 4,050 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the southwestern willow flycatcher, and contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. Implementation of the conservation measures will also contribute to recovery by increasing the amount of new breeding habitat by 2,233 acres, in addition to replacing the extent of affected habitat.

The LCR MSCP conservation measures will contribute to the objectives of the Southwestern Willow Flycatcher Recovery Plan (U.S. Fish and Wildlife Service 2002b). The southwestern willow flycatcher Lower Colorado Recovery Unit currently supports approximately 146 occupied nesting territories and a target of 525 occupied nesting

territories in the unit for removal from the ESA endangered and threatened species list. Implementation of the LCR MSCP will maintain existing occupied habitats in a condition that will continue to function over time and, assuming a mean nesting territory size of 10 acres, the LCR MSCP would create sufficient habitat to support 405 nesting territories that would be available for occupancy by nesting pairs.

5.7.3 Desert Tortoise

5.7.3.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures may result in take of individuals (i.e., mortality of individuals associated with operation of vehicles and equipment in habitat). Small amounts of desert tortoise habitat could be removed if new infrastructure (e.g., access roads) necessary to develop and maintain LCR MSCP conservation areas is constructed in habitat. The level of habitat removal, however, is expected to be minimal and is not expected to result in harm (i.e., injury or mortality of individuals). Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of 192 acres of desert tortoise habitat.

5.7.3.2 Conservation Measures

DETO1—Acquire and protect 230 acres of existing unprotected occupied habitat. Consistent with the mitigation measures identified in the document "Compensation for Desert Tortoise" (Desert Tortoise Conservation Team 1991), the LCR MSCP will acquire and protect 230 acres of unprotected occupied desert tortoise habitat. The acquired habitat will be transferred to an appropriate management agency for permanent protection of species' habitat. Although creation of replacement habitat is not considered feasible, protecting existing occupied habitat will ensure that implementation of covered activities and LCR MSCP conservation measures do not adversely affect the existing distribution, abundance, or population viability of the desert tortoise within the LCR MSCP planning area.

DETO2—Avoid impacts on individuals and their burrows. To avoid and minimize impacts on desert tortoise, the following measures, which are derived from USFWS's *Field Survey Protocol for Any Federal Action That May Occur within the Range of the Desert Tortoise* (U.S. Fish and Wildlife Service 1992) and the Desert Tortoise Council's *Guidelines for Handling Desert Tortoises during Construction Projects* (Desert Tortoise Council 1994), will be implemented.

1. Before implementing non-flow-related covered activities and LCR MSCP conservation measures in desert tortoise habitat, presence or absence surveys will be conducted using approved USFWS survey protocols to locate desert tortoises and their burrows (U.S. Fish and Wildlife Service 1992). The number and location of all tortoises or tortoise sign (e.g., shells, bones, scutes, limbs, scats, burrows, pellets, tracks, egg shell fragments, courtship rings, drinking sites, and mineral licks) that occur within the project area and its zone of influence and whether any tortoises

occur outside of the project area whose home ranges may overlap the project area or its zone of influence should be identified. The project area is defined as any area that will be cleared or partially cleared; have vehicles on or adjacent to it; be temporarily or permanently used for equipment or materials storage, loading, or unloading; or will have its soil or vegetation damaged, fragmented, or disturbed. Desert tortoise presence or absence surveys should be conducted during the typical period of activity for the tortoise (i.e., March 25 to May 31). Surveys should be conducted during daylight hours. The USFWS considers the results of a presence or absence survey, including the zone of influence, to be valid for no more than 1 year, though the time period may be significantly reduced, depending on project size, location, or proximity to other land disturbance.

2. If desert tortoises are present, the covered activity or LCR MSCP activity will be modified to avoid take of individuals and their burrows. However, if impacts cannot be avoided, clearance surveys will be conducted to locate desert tortoises that will be removed and relocated to other habitat areas. Clearance surveys should be conducted to locate all desert tortoises above and below ground within the project area that would be temporarily relocated or salvaged using the USFWS clearance survey protocol (U.S. Fish and Wildlife Service 1992). Clearance surveys should be conducted immediately prior to surface disturbance at each site within the project area. Surveys should be conducted during daylight hours.

3. If impacts cannot be avoided, desert tortoises should be removed and relocated to other habitat areas, if appropriate. The Desert Tortoise Council guidelines for determining whether tortoises should be moved, mapping tortoise burrows, determining whether burrows should be excavated, finding tortoises in burrows, excavating burrows, constructing artificial burrows, handling tortoise eggs, handling tortoises, processing tortoises, translocating tortoises, and releasing tortoises should be followed (Desert Tortoise Council 1994).

5.7.3.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to protect 230 acres of unprotected occupied desert tortoise habitat achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Mohave population of desert tortoises. Implementation of this measure will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully mitigating the loss of habitat.

5.7.4 Bonytail

5.7.4.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 399 acres of bonytail habitat, stranding, and desiccation losses in the river and connected backwaters, and entrainment of individuals at diversions.

5.7.4.2 Conservation Measures

BONY1—Coordinate bonytail conservation efforts with the USFWS and recovery programs for endangered fish species in the Lower Basin. The LCR MSCP is not a recovery implementation program for the bonytail in the Lower Basin. However, because the planning area overlies bonytail habitats that may be significant components of recovery, and the conservation measures included in the plan can provide resources to a separately organized recovery program, the LCR MSCP will be a contributor to recovery efforts. In that role, the LCR MSCP will interact with the USFWS or any formal recovery program developed in the future for the Lower Basin to ensure that conservation measures included in the conservation plan will be implemented in support of recovery efforts to meet recovery goals for the bonytail in the Lower Basin. This will allow coordination of stocking, research, monitoring, and the funding of other types of conservation efforts inside and outside the LCR MSCP planning area. The LCR MSCP may also use funding programmed for bonytail augmentation (BONY3) and other bonytail conservation measures to implement other recovery activities identified by the USFWS or a future formal recovery program if it is determined through the adaptive management process (Section 5.12) and with concurrence of the USFWS that providing such funding would more effectively contribute to recovery of the bonytail. The LCR MSCP conservation measures are designed to be flexible and adaptable to allow for changing needs and priorities in bonytail recovery efforts over the term of the permit. The LCR MSCP recognized that this flexibility would be extremely valuable as interim benchmarks to meeting the 2002 recovery goals and changes to recovery needs identified from research and monitoring were developed over time. In order to define the amount of conservation the LCR MSCP would contribute for the bonytail, some assumptions on how funds would be spent were made for the purposes of costing out the program. The adaptive management program, relying on research, monitoring, and other information, will guide the implementation of the conservation measures to mitigate incidental take and contribute to recovery.

BONY2—Create 360 acres of bonytail habitat. Create 360 acres of backwater with depth, vegetation, and substrate characteristics that provide the elements of bonytail habitat. This created backwater will also provide habitat for the razorback sucker. Created backwaters will be designed and managed as described in Section 5.4.3.4. At a minimum, created backwaters will contain the physical, chemical, and biological conditions suitable for the establishment and maintenance of healthy fish populations in the LCR.

BONY3—Bonytail augmentation program. The LCR MSCP will provide a level of funding to support implementation of a stocking/augmentation program for the bonytail providing for the stocking of up to 620,000 subadult bonytail (at least 300 mm in length) into the designated critical habitat for the species in Reaches 2–3, and in Reaches 4 and 5 of the LCR. The figure of 620,000 fish is not a target number for the LCR but represents an assumption (see BONY1) used to define the extent of funding that would be available, with the understanding that the adaptive management process (see Section 5.12.2.2) would guide the actual stocking program. The elements of the augmentation program divide the conservation effort into the three reaches with numbers of fish per year per reach:

1. Annually augment 4,000–6,000 subadult fish for 40 years in Lake Mohave to maintain the population (LCR MSCP stocking would follow completion of USFWS's augmentation commitment; estimate 10,000 subadult fish augmented per year for 10 years; consequently, the LCR MSCP commitment is estimated at a mean annual average of 5,000 subadult fish per year for 40 years, for a total of 200,000 fish augmented).
2. Annually augment 4,000 subadult fish for 50 years in Lake Havasu to maintain the population (200,000 total augmentation).
3. When technology permits, implement an experimental augmentation of 8,000 subadult fish annually in the Parker-Imperial river reach (Reaches 4 and 5) for 5 consecutive years within the 50-year program (40,000 total augmentation) and conduct intensive follow-up monitoring.
4. Annually augment 4,000 subadult fish to establish and maintain populations in the Parker-Imperial river reach (Reaches 4 and 5) for 45 years (180,000 total augmentation).

The number of fish that would be stocked in each reach would be based on the results of monitoring and research. Factors to be evaluated include the survival of stocked fish (including examination of rearing methods, stocking methods, and size of fish stocked), habitat usage, quality and availability, and other information. Stocking of bonytail in any reach would cease, even if the numbers described herein had not been stocked, if monitoring and research demonstrate: (1) no need for additional stockings to provide adults for genetic refuge or for evaluation of management activities related to creating a self-sustaining population (i.e., species recovery goals have been achieved); (2) results of monitoring and research indicate that management activities other than stocking would be more effective in contributing to recovery of the species; (3) there are factors in the reach that are not conducive to the survival of stocked fish to become adults or to be managed toward a self-sustaining population; or (4) that other biological or other factors warrant cessation of stocking. Funds not expended for growing and stocking subadult bonytail would continue to be available to fund other management measures that would minimize and mitigate incidental take and contribute to recovery. Other such management measures would be identified and implemented through the adaptive management process (Section 5.12.1), which requires that any proposed changes in the conservation measures be approved by the USFWS prior to adoption and implementation. As described in conservation measure BONY1, the number of bonytail stocked could also be reduced if funding provided for stocking bonytail is reallocated to support implementation of other conservation measures.

The proposed augmentation program assumes that the USFWS will complete its obligation to stock 125,000 subadult fish in Lake Mohave (an estimated 100,000 subadult fish remain to be stocked) and that the LCR MSCP will incorporate annual augmentations to maintain the Lake Mohave population that becomes established as a result of USFWS's augmentations. All fish stocked under the LCR MSCP augmentation program would meet applicable disease and parasite control protocols established for fish health.

BONY4—Evaluate and develop, if necessary, additional bonytail rearing capacity. Additional rearing capacity, if needed, would be developed through cooperation between

AGFD, CDFG, NDOW, USFWS, and other LCR MSCP participants, or fish may be acquired from other sources. During the initial years of implementation, the LCR MSCP will evaluate the efficacy of existing or proposed bonytail production programs and facilities and develop the methods required to produce and rear the fish. Given the minimal information on the biology and ecology of the species, the success of large-scale production is uncertain. Also, the target size for subadults is 300 mm total length. Existing information indicates that hatchery and pond rearing of bonytail to 300 mm is difficult, requiring specific nutritional and spatial conditions. Opportunities to increase bonytail production could include defining feeding regimes, raceway and pond densities, and other factors that affect growth and testing the efficacy of raising fish in disconnected backwaters that are predator free. In the context of the integrated landscape mosaic (e.g., use of created disconnected backwaters), a "pilot project" grow-out facility will be developed for bonytail within the LCR MSCP planning area.

Until rearing capacity and aquaculture techniques can be increased sufficiently to produce the numbers of fish required for the augmentation strategy described in conservation measures BONY3, the LCR MSCP will stock the numbers of fish that can be produced up to the amounts described above. Annual augmentation targets for the first years of the program, therefore, may need to be shifted to later in the program, when increased rearing capacity is at full capacity. The LCR MSCP augmentation strategy assumes that fish production technology can be developed sufficiently to produce the numbers of subadult fish required for augmentation. If production of sufficient numbers of fish for the augmentation program is not possible, however, in addition to augmenting the numbers of fish that can be produced, the LCR MSCP will focus the expenditure of remaining augmentation funds on other types of management activities that will benefit the species (e.g., additional research, habitat improvements).

BONY5—Conduct monitoring and research, and adaptively manage bonytail augmentations and created habitat. Monitoring and research will be conducted to gather information necessary to adaptively manage bonytail conservation, including aggressive monitoring of fish response following augmentations to gather information regarding habitat use and fish movement, to increase the success of subsequent management of the species.

The LCR MSCP will implement an adaptive management process to reevaluate the augmentation strategy for bonytail, based on the results of monitoring and research. Monitoring and focused research will be a component of the adaptive management process. For example, the stocking of 8,000 subadult fish for 5 consecutive years below Parker Dam (conservation measure BONY3, submeasure 3) will be conducted as an adaptive management experiment, elements of which will include focusing augmentations in locations that currently support the species, followed by intensive monitoring and research for an estimated 7–8 years. Release of fish into the LCR will target a mix of riverine and lacustrine habitat types in Reaches 2 and 3. Augmented bonytail released will be marked with an appropriate batch-marking methodology and a statistically valid subset of released fish may also be PIT tagged or identified with other appropriate technology providing a similar level of individual fish identification. Monitoring will focus on determining key environmental correlates affecting survival, growth, movement, and reproduction (e.g., key habitat [e.g., depth, velocity, channel form, cover, substrate], continuity, water temperature, food, predation).

Following the 7–8-year intensive monitoring and research period, the information and insights gained will focus expenditure of the remaining funds on those management activities potentially contributing the most to achieving the recovery goals for bonytail. As appropriate, the management activities may include changes to the LCR MSCP participant's proposed augmentation approach, rates, and targeted areas. The monitoring and research information will also guide maintenance, enhancement, and creation of bonytail habitat (e.g., backwaters).

5.7.4.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 360 acres of habitat and stocking of up to 620,000 subadult bonytail, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the bonytail, and contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of replacing affected habitat and stocking subadult fish and will contribute to attainment of the recovery goals established for the species (U.S. Fish and Wildlife Service 2002c).

The bonytail recovery goals in the amendment and supplement to the Bonytail Recovery Plan include the following requirements for downlisting the species relative to the Lower Basin Recovery Unit: a genetic refuge is maintained in a suitable location (e.g., Lake Mohave, Lake Havasu) and two genetically and demographically viable, self-sustaining populations are maintained (U.S. Fish and Wildlife Service 2002c).

Although it is not the Applicants' obligation to achieve the recovery goals, the activities proposed by the Applicants conform with and contribute to the recovery goals, including:

- reestablish populations through augmentation and reintroductions,
- maintain historical genetic variability as reflected in existing populations of bonytail and maintain a genetic refuge in a suitable location in the Lower Basin, and
- investigate habitat requirements and management options for all life stages.

Maintaining bonytail populations in the LCR MSCP planning area currently depends on augmenting adult assemblages with hatchery-produced subadults. Augmentation proposed under the LCR MSCP will contribute to maintaining or increasing adult abundance. Augmentation may also contribute to maintaining a genetic refuge in a suitable location (e.g., Lake Mohave, Lake Havasu), one of the recovery criteria for downlisting and delisting of the species. The criteria for downlisting and delisting also requires maintenance of genetically and demographically viable, self-sustaining populations of bonytail in the Lower Basin Recovery Unit (U.S. Fish and Wildlife Service 2002c).

Although management tasks needed to establish a self-sustaining population have not been specifically identified, augmentation will help maintain adult assemblages. The maintenance of adult assemblages provides the opportunity for successful cohort

production, assuming that currently unknown changes in environmental circumstances were to support successful spawning and survival through the larval and juvenile life stages. Augmentation also contributes to an adult abundance that will support research and monitoring that may be necessary to identify and develop specific management activities to minimize or remove existing constraints to establishing self-sustaining populations of bonytail.

5.7.5 Humpback Chub

5.7.5.1 Summary of Effects

Transitory humpback chub habitat that forms within the high pool elevation of Lake Mead when Lake Mead reservoir elevations are low could be lost when reservoir elevations rise, thus inundating the transitory habitat. Up to an estimated 62 miles of transitory river channel of the Colorado River that could form within the full-pool elevation of Lake Mead when reservoir elevations are lowered to 950 feet msl could be affected when reservoir levels subsequently rise.

5.7.5.2 Conservation Measures

HUCH1—Provide funding to support existing humpback chub conservation programs. The LCR MSCP will provide $10,000 per year for 50 years ($500,000 total) to the Glen Canyon Dam Adaptive Management Program or other entity approved by the USFWS to support implementation of planned, but unfunded, species conservation measures and, as appropriate, to fund species conservation measures in the lower Grand Canyon of the Colorado River upstream of Lake Mead NRA. The purpose and use of this funding would be reevaluated if the species was recovered and delisted during the term of the LCR MSCP.

5.7.5.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to fund planned, but unfunded, conservation measures to be undertaken by the Glen Canyon Dam Adaptive Management Workgroup achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the humpback chub, and contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the Lower Basin of the Colorado River is maintained or increased.

5.7.6 Razorback Sucker

5.7.6.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 399 acres of razorback sucker habitat, stranding and desiccation losses in the river and connected backwaters, and entrainment of individuals at diversions.

5.7.6.2 Conservation Measures

RASU1—Coordinate razorback sucker conservation efforts with the USFWS and recovery programs for endangered fish species in the Lower Basin. The LCR MSCP is not a recovery implementation program for the razorback sucker in the Lower Basin. However, because the planning area overlies razorback habitats that may be significant components of recovery, and the conservation measures included in the plan can provide resources to a separately organized recovery program, the LCR MSCP will be a contributor to recovery efforts. In that role, the LCR MSCP will interact with USFWS or any formal recovery program developed in the future for the Lower Basin to ensure that conservation measures included in the conservation plan will be implemented in support of recovery efforts to meet recovery goals for the razorback sucker in the Lower Basin. This will allow coordination of stocking, research, monitoring, and the funding of other types of conservation efforts inside and outside the LCR MSCP planning area. The LCR MSCP may also use funding programmed for razorback sucker augmentation (RASU3) and other razorback sucker conservation measures to implement other recovery activities identified by the USFWS or a future formal recovery program if it is determined through the adaptive management process (Section 5.12) and with concurrence of the USFWS that providing such funding would more effectively contribute to recovery of the razorback sucker.

The LCR MSCP conservation measures are designed to be flexible and adaptable to allow for changing needs and priorities in razorback sucker recovery efforts over the term of the permit. The LCR MSCP recognized that this flexibility would be extremely valuable as interim benchmarks to meeting the 2002 recovery goals and changes to recovery needs identified from research and monitoring were developed over time. In order to define the amount of conservation the LCR MSCP would contribute for the razorback sucker, some assumptions on how funds would be spent were made for the purposes of costing out the program. The adaptive management program, relying on research, monitoring, and other information will guide the implementation of the conservation measures to mitigate incidental take and contribute to recovery.

RASU2—Create 360 acres of razorback sucker habitat. Create 360 acres of backwater with water depth, vegetation, and substrate characteristics that provide the elements of razorback sucker habitat. This created backwater will also provide habitat for the bonytail. Created backwaters will be designed and managed as described in Section 5.4.3.4. At a minimum, created backwaters will contain the physical, chemical, and biological conditions suitable for the establishment and maintenance of healthy fish populations in the LCR.

RASU3—Razorback sucker augmentation program. The LCR MSCP will provide a level of funding to support implementation of a stocking/augmentation program for the razorback sucker, providing for the stocking of up to 660,000 subadult razorback suckers (at least 300 mm in length) into the designated critical habitat for the species in Reach 3, and in Reaches 4 and 5 of the LCR. The figure of 660,000 fish is not a target number for the LCR but represents an assumption (see RASU1) used to define the extent of funding that would be available, with the understanding that the adaptive management process (see Section 5.12.2.2) would guide the actual stocking program.

The elements of the augmentation program divide the conservation effort into the three reaches with numbers of fish per year per reach:

1. Implement an experimental augmentation, at a site(s) to be selected in cooperation with USFWS and state game and fish agencies, of 24,000 subadult razorback suckers each year for 5 years (120,000 total augmentation), and conduct intensive follow-up monitoring. When razorback sucker production capacity allows, razorback sucker production will be ramped up, with a target production of 120,000 300-mm subadult fish over a 5-year period (i.e., about 24,000 subadult fish per year). Of the 120,000 subadult fish, 6,000 300-mm fish will be stocked annually above Parker Dam and 6,000 300-mm fish below Parker Dam to facilitate maintenance of current juvenile and adult abundance. The augmentation program will also support maintenance and protection of the genetic diversity of existing populations in Lake Mohave (conservation measure RASU4).
2. Annually augment the existing population by stocking up to 6,000 subadult razorback sucker for 45 years in Lake Havasu (270,000 total augmentation).
3. Annually augment the existing population by stocking up to 6,000 subadult razorback sucker for 45 years below Parker Dam (270,000 total augmentation).

The number of fish that would be stocked in each reach would be based on the results of monitoring and research. Factors to be evaluated include the survival of stocked fish (including examination of rearing methods, stocking methods, and size of fish stocked), habitat usage, quality and availability, and other information. Stocking of razorback sucker in any reach would cease, even if the numbers described herein had not been stocked, if monitoring and research demonstrate: (1) no need for additional stockings to provide adults for genetic refuge or for evaluation of management activities related to creating a self-sustaining population (i.e., species recovery goals have been achieved); (2) results of monitoring and research indicate that management activities other than stocking would be more effective in contributing to recovery of the species; (3) there are factors in the reach that are not conducive to the survival of stocked fish to become adults or to be managed toward a self-sustaining population; or (4) that other biological or other factors warrant cessation of stocking. Funds not expended for growing and stocking subadult razorback sucker would continue to be available to fund other management measures that would minimize and mitigate incidental take and contribute to recovery. Other such management measures would be identified and implemented through the adaptive management process (Section 5.12.1), which requires that any proposed changes in the conservation measures be approved by the USFWS prior to adoption and implementation. As described in conservation measure RASU1, the number of razorback sucker stocked could also be reduced if funding provided for stocking razorback sucker is reallocated to support implementation of other conservation measures.

RASU4—Develop additional razorback sucker rearing capacity. The LCR MSCP, in cooperation with AGFD, CDFG, NDOW, USFWS, and other LCR MSCP participants, will develop additional razorback sucker rearing capacity or will acquire the necessary numbers of fish from other sources. Methods to increase rearing capacity to accommodate fish augmentations will include testing the efficacy of raising fish or creating recruiting populations in disconnected backwaters that are predator free. In the context of the integrated landscape mosaic that will provide a variety of habitats and management opportunities (e.g., use of created disconnected backwaters), grow-out facilities will be developed for razorback sucker in the LCR MSCP planning area.

Until rearing capacity can be increased sufficiently to produce the numbers of fish required for the augmentation strategy described in conservation measure RASU3, the LCR MSCP will monitor species' response to previous augmentations and will stock the numbers of fish that can be produced up to the amounts described in RASU3. Annual augmentation targets for the first years of the program, therefore, may need to be shifted until later in the program, when increased rearing capacity is at full capacity.

RASU5—Support ongoing razorback conservation efforts at Lake Mohave. Provide support to maintain the current Lake Mohave Program (Native Fish Work Group) goal of maintaining a population of 50,000 adult razorback sucker in Lake Mohave as a genetic refuge.

RASU6—Conduct monitoring and research, and adaptively manage razorback sucker augmentations and created habitat. Monitoring and research will be conducted to gather information necessary to adaptively manage razorback sucker conservation, including continued monitoring of fish response to previous augmentations, aggressive monitoring of fish response following LCR MSCP augmentations to gather information regarding habitat use, and fish movement, to increase the success of subsequent management of the species.

The LCR MSCP will implement an adaptive management process to reevaluate the augmentation strategy for razorback sucker based on the results of monitoring and research. Monitoring and focused research will be a component of the adaptive management process. In particular, the stocking of 24,000 subadult fish for 5 consecutive years (conservation measure RASU3, submeasure 1) will be conducted as an adaptive management experiment, elements of which will include focusing augmentations in locations that currently support large numbers of fish, followed by intensive monitoring and research for an estimated 7–8 years. Release of fish into the LCR will target a mix of riverine and lacustrine habitat types in Reaches 3–5. Razorback sucker released into Reaches 2–5 will be marked with wire-coded tags and a statistically valid subset of released fish may also be PIT tagged or identified with other appropriate technology, providing a similar level of individual fish identification. Monitoring and research will focus on determining key environmental correlates affecting survival, growth, movement, and reproduction (e.g., key habitat [e.g., depth, velocity, channel form, cover, substrate], continuity, water temperature, food, predation).

Following the 7–8-year intensive monitoring and research period, the information and insights gained will focus expenditure of the remaining LCR MSCP funds allocated for razorback sucker augmentations on those management activities potentially contributing the most to achieving the recovery goals for razorback sucker. As appropriate, the

management activities may include changes to the Applicants' proposed augmentation approach, rates, and augmentation sites. The monitoring and research information will also guide maintenance, enhancement, and creation of razorback sucker habitat (e.g., backwaters).

RASU7—Provide funding and support for continuation of the Reclamation/SNWA ongoing Lake Mead razorback sucker studies. The LCR MSCP will continue to fund and support the ongoing studies of razorback suckers in Lake Mead that were implemented under the ISC/SIA BO. The studies are anticipated to be completed within 5–10 years. The focus of the studies will be to resolve any remaining questions about the location of populations of razorback suckers in Lake Mead from the lower Grand Canyon (Separation Canyon) area downstream to Hoover Dam, documenting use and availability of spawning areas at various water elevations, clarifying substrate requirements, monitoring potential nursery areas, continuing ageing studies, and confirming recruitment events that may be tied to physical conditions in the lake. The LCR MSCP and USFWS will agree to the term and further define the scope of the studies. These studies may be followed by further research and monitoring within the adaptive management program of the LCR MSCP.

RASU8—Continue razorback conservation measures identified in the ISC/SIA BO. Reclamation will continue to implement, as part of the LCR MSCP, the following conservation measures identified in the ISC/SIA BO:

1. Reclamation will continue existing operations on Lake Mohave that benefit native fish during the term of the LCR MSCP and will explore additional ways to provide benefits to native fish.
2. Reclamation will, to the maximum extent practicable, provide rising spring (February–April) water surface elevations of 5–10 feet on Lake Mead, to the extent hydrologic conditions allow. This operation plan will be pursued through Beach Habitat Building Flows (BHBF) and/or equalization and achieved through the Adaptive Management and Annual Operating Plan processes, as determined for spawning razorback suckers.
3. Reclamation will monitor water levels of Lake Mead from February to April of each year during the term of the LCR MSCP. The LCR MSCP will evaluate the impacts to razorback spawning at water levels below an elevation of 1,160 feet msl. The ISC/SIA BO includes a conservation measure to collect and rear larval razorbacks in Lake Mead if the lake elevation falls below this level, based on an assumption that razorback spawning would be reduced or eliminated at water elevations below that level. It should be noted, however, that the spawning population of razorback sucker found in Echo Bay moved to a lower elevation in 2002 and spawned because the spawning location they had previously used was dry. This change indicates that razorback sucker can successfully move their spawning location into progressively lower elevations as the lake recedes. Given this new information, the LCR MSCP and USFWS will evaluate the data developed in conservation measure RASU6 and determine whether larva collection is appropriate and, if so, at what water elevation it should be implemented.

5.7.6.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 360 acres of habitat and stocking of up to 660,000 subadult razorback suckers over the term of the LCR MSCP, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the razorback sucker, and contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of replacing affected habitat and stocking subadult fish and will contribute to attainment of the recovery goals established for the species (U.S. Fish and Wildlife Service 2002e).

Although it is not the Applicants' obligation to achieve the recovery goals, the activities proposed by the Applicants conform with and contribute to three of the recovery goals:

- reestablish populations through augmentation and reintroductions,
- maintain historical genetic variability as reflected in existing populations of razorback sucker in Lake Mohave, and
- investigate habitat requirements and management options for all life stages.

Maintaining razorback sucker populations in the LCR MSCP planning area is currently dependent on augmenting adult assemblages with hatchery-produced subadults. Augmentation proposed under the LCR MSCP Conservation Plan will contribute to maintaining or increasing adult abundance, assisting in achievement of abundance goals identified by the Native Fish Work Group for Lake Mohave, Lake Havasu, and the river between Parker and Imperial Dams. Augmentation may also contribute to maintaining a genetic refuge in Lake Mohave, one of the recovery criteria for downlisting and delisting of the species. The criteria for downlisting and delisting also requires maintenance of genetically and demographically viable, self-sustaining populations of razorback sucker in the Lower Basin Recovery Unit (U.S. Fish and Wildlife Service 2002e).

Although management tasks needed to establish a self-sustaining population have not been specifically identified, augmentation will help maintain adult assemblages. The maintenance of adult assemblages provides the opportunity for successful cohort production, assuming that currently unknown changes in environmental circumstances were to support successful spawning and survival through the larval and juvenile life stages. Augmentation also contributes to an adult abundance that will support research and monitoring that may be necessary to identify and develop specific management activities to minimize or remove existing constraints to establishing self-sustaining populations of razorback sucker.

5.7.7 Western Red Bat

5.7.7.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in removal of 161 acres of roosting habitat, disturbance to roosting western red bats, and, potentially, a reduction in the diversity and abundance of insects that are food for the western red bat. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 604 acres of roosting habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.7.2 Conservation Measures

WRBA1—Conduct surveys to determine the distribution of the western red bat. Conduct investigations to identify the distribution of the western red bat in Reaches 3–5.

WRBA2— Create 765 acres of western red bat roosting habitat. Of the 7,260 acres of cottonwood-willow and honey mesquite to be created as covered species habitat, at least 765 acres will be designed and created to provide western red bat roosting habitat. Created roosting habitat will be designed and managed to support cottonwood-willow types I and II and honey mesquite type III. The LCR MSCP process for selecting sites to establish cottonwood-willow and honey mesquite as habitat for other covered species habitat will, based on the information collected under conservation measure WRBA1, give priority, when consistent with achieving LCR MSCP goals for other covered species, to selecting sites that are occupied by the western red bat in Reaches 3–5. As described in Section 5.4.3, created cottonwood-willow and honey mesquite land cover will be designed to establish stands that will support a substantially greater density and diversity of plant species that will provide roost trees and that are likely to support a greater abundance of insect prey species than is currently produced in the affected land cover types.

5.7.7.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures that will maintain or increase the production of flying insect food items and establish replacement roost trees achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the western red bat. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of creating land cover types that will provide roost trees and facilitate the production of an abundance of insects used as food by the western red bat.

5.7.8 Western Yellow Bat

5.7.8.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in removal of 161 acres of roosting habitat, disturbance to roosting western yellow bats, and, potentially, a reduction in the diversity and abundance of insects that are food for the western yellow bat. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 604 acres of roosting habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.8.2 Conservation Measures

WYBA1—Conduct surveys to determine the distribution of the western yellow bat. Conduct investigations to identify the distribution of the western yellow bat in Reaches 3–5.

WYBA2—Avoid removal of western yellow bat roost trees. To the extent practicable, avoid removal of palm trees that could serve as roosts for the western yellow bat when creating covered species habitats.

WYBA3—Create 765 acres of western yellow bat roosting habitat. Of the 7,260 acres of cottonwood-willow and honey mesquite to be created as covered species habitat, at least 765 acres will be designed and created to provide western yellow bat roosting habitat. Created roosting habitat will be designed and managed to support cottonwood-willow types I and II and honey mesquite type III. The LCR MSCP process for selecting sites to establish cottonwood-willow and honey mesquite as habitat for other covered species habitat will, based on the information collected under conservation measure WYBA1, give priority, when consistent with achieving LCR MSCP goals for other covered species, to selecting sites that are occupied by the western yellow bat in Reaches 3–5. As described in Section 5.4.3, created cottonwood-willow and honey mesquite land cover will be designed to establish stands that will support a substantially greater density and diversity of plant species that will provide roost trees and that are likely to support a greater abundance of insect prey species than is currently produced in the affected land cover types.

5.7.8.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures that will maintain or increase the production of flying insect food items and establish replacement roost trees achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the western yellow bat. Implementation of

these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of creating land cover types that will provide roost trees and facilitate the production of an abundance of insects used as food by the western yellow bat.

5.7.9 Desert Pocket Mouse

5.7.9.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in take of individuals and the temporary disturbance to or removal of desert pocket mouse habitat if habitat creation projects are implemented in occupied habitat.

5.7.9.2 Conservation Measures

DPMO1—Conduct surveys to locate desert pocket mouse habitat. Conduct surveys to locate desert pocket mouse habitat that could be affected by LCR MSCP habitat creation–related activities to determine whether the habitat is occupied. If the habitat is occupied, design habitat creation–related activities to avoid the habitat. If the habitat cannot be avoided, to the extent practicable, restore the disturbed habitat area onsite following completion of the activities and protect and incorporate the habitat into the conservation area. If the habitat cannot be restored onsite, create amount of habitat at least equal to the extent of disturbed habitat elsewhere in the conservation area. Restoring disturbed habitat will ensure that covered activities do not adversely affect the existing or potential future enhanced distribution, abundance, or population viability of the desert pocket mouse in the LCR MSCP planning area.

5.7.9.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to avoid impacts on or restore disturbed desert pocket mouse habitat achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the desert pocket mouse. Implementation of this measure will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully mitigating impacts.

5.7.10 Colorado River Cotton Rat

5.7.10.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in take of individuals, temporary disturbance of Colorado River cotton rat habitat

associated with habitat creation activities, and the loss of up to 64 acres of habitat. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 3 acres of habitat. Some additional limited and low value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.10.2 Conservation Measures

CRCR1—Conduct research to better define Colorado River cotton rat habitat requirements. Conduct research, if needed, to better define the elements of Colorado River cotton rat habitat and provide information necessary to design and manage created habitat.

CRCR2—Create 125 acres of Colorado River cotton rat habitat. Of the 512 acres of marsh to be created to create Yuma clapper rail habitat (Section 5.7.1), at least 125 acres will be designed to also provide Colorado River cotton rat habitat in Reaches 3 and 4 near occupied habitat (Figure 5-2). Additional habitat may be provided by marsh vegetation that establishes along margins of the 360 acres created backwaters (Section 5.4.3.4).

5.7.10.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to create 125 acres of habitat achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Colorado River cotton rat. Implementation of this measure will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully mitigating impacts.

5.7.11 Yuma Hispid Cotton Rat

5.7.11.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 5 acres of habitat, take of individuals, and temporary disturbance of Yuma hispid cotton rat habitat associated with habitat creation activities. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of 71 acres of species habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.11.2 Conservation Measures

YHCR1—Conduct research to better define Yuma hispid cotton rat habitat requirements. Conduct research, if needed, to better define the elements of Yuma hispid cotton rat habitat and provide information necessary to design and manage created habitat.

YHCR2—Create 76 acres of Yuma hispid cotton rat habitat. Of the 5,940 acres of cottonwood-willow to be created as habitat for covered species, at least 76 acres will be designed to provide habitat for the Yuma hispid cotton rat in Reaches 6 and 7 near occupied habitat. Created Yuma hispid cotton rat habitat will be designed and managed to support a moist herbaceous understory, an element of the species' habitat.

5.7.11.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to create 76 acres of habitat achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Yuma hispid cotton rat. Implementation of this measure will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully mitigating impacts.

5.7.12 Western Least Bittern

5.7.12.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 173 acres of western least bittern habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 70 acres of habitat. Some additional limited and low value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.12.2 Conservation Measures

LEBI1—Create 512 acres of western least bittern habitat. Create and manage 512 acres of marsh to provide western least bittern habitat (Figure 5-2). This created habitat will also be habitat for the Yuma clapper rail (conservation measure CLRA1). Habitat will be created in patches as large as possible. Smaller patches are likely within the range of habitat patch sizes used by the species for foraging and dispersal, and larger patches may be used for breeding. Western least bittern habitat will be created and

maintained as described in Section 5.4.3.3. Marshes created to provide western least bittern habitat will be designed and managed to provide an integrated mosaic of wetland vegetation types, water depths, and open water areas. Priority will be given, when consistent with achieving LCR MSCP goals for other covered species, to establishing habitat near occupied habitat. The largest numbers of western least bitterns in the LCR MSCP planning area are located at Topock Marsh and marshes near Imperial Dam, but they are present in suitable marshes throughout the LCR MSCP planning area. Within this mosaic of marsh conditions, western least bittern habitat will generally be provided by patches of bulrush and cattails interspersed with small patches of open water that maintain water depths no greater than 12 inches.

5.7.12.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 512 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the western least bittern, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. In addition, implementation of the conservation measures will benefit the western least bittern by increasing the amount of new habitat in the LCR MSCP planning area by 269 acres, in addition to replacing the extent of affected habitat.

5.7.13 California Black Rail

5.7.13.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 72 acres of California black rail habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the additional loss of 31 acres of habitat. Some additional limited and low value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.13.2 Conservation Measures

BLRA1—Create 130 acres of California black rail habitat. Of the 512 acres of LCR MSCP–created marsh, 130 acres will be created and managed to provide California black rail habitat near occupied habitat in Reaches 5 and 6 (Figure 5-2). This habitat will be provided by designing and managing at least 130 acres of the 512 acres of created Yuma clapper rail habitat to provide habitat for both species. Habitat will be created in patches

as large as possible but will not be created in patches smaller than 5 acres. Additional California black rail habitat may be provided by marsh vegetation that becomes established along margins of the 360 acres of backwaters that will be created in Reaches 5 and 6. These small patches of habitat provide cover for dispersing rails, thereby facilitating linkages between existing breeding populations and the colonization of created habitats.

Design of created habitat will be directed toward establishing moist-soil marshes that support a predominance of three-square bulrush with suitable water depths to replicate conditions present at Mittry Lake and Bill Williams Delta that support the species. Habitat will be designed and managed to provide an integrated mosaic of patches of cattail, bulrush, and mudflat, interspersed with small patches of open water with varying water depths.

BLRA2—Maintain existing important California black rail habitat areas. The Applicants, under agreements with cooperating land management agencies, will provide funding to those agencies to maintain a portion of existing California black rail habitat in the LCR MSCP planning area (Section 5.4.2). Maintaining important existing habitat areas is necessary to ensure the continued existence of California black rails in the LCR MSCP planning area, provide for the production of individuals that could disperse to and nest in LCR MSCP–created habitats, and support future recovery of the species. Habitat maintenance would likely be undertaken in conjunction with the maintenance of existing Yuma clapper rail habitat.

5.7.13.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including maintenance of existing important habitat areas and creation of 130 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the California black rail, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. In addition, implementation of the conservation measures will benefit the California black rail by increasing the amount of new habitat in the LCR MSCP planning area by 27 acres, in addition to replacing the extent of affected habitat.

5.7.14 Yellow-Billed Cuckoo

5.7.14.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 1,435 acres of yellow-billed cuckoo habitat and harassment of individuals. Implementation of Federal non-flow-related covered activities addressed in

the LCR MSCP BA could result in the loss of an additional 99 acres of species habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.14.2 Conservation Measures

YBCU1—Create 4,050 acres of yellow-billed cuckoo habitat. Of the 5,940 acres of created cottonwood-willow, at least 4,050 acres will be designed and created to provide habitat for this species. Created habitat will be designed and managed to support cottonwood-willow types I–III that provide breeding habitat for this species. The created cottonwood-willow would also function as migration habitat for birds that migrate along the LCR. A total of 2,700 acres of created habitat will be designed and managed to provide both yellow-billed cuckoo and southwestern willow flycatcher habitat, and 1,350 acres will be designed and managed to specifically provide habitat for the yellow-billed cuckoo.

The created habitat will be established in patches as large as possible but will not be created in patches smaller than 25 acres to achieve, based on the best available information, the minimum habitat patch size requirements of the species. Of the 1,350 acres of habitat to be created specifically for the southwestern willow flycatcher (Section 5.7.2), patches that support cottonwood-willow types I–III of at least 25 acres will also support habitat for the yellow-billed cuckoo.

In addition to the spatial replacement of affected habitats, the quality of created habitats will be substantially greater than affected habitats that are currently dominated by saltcedar. Cottonwood-willow land cover created to provide yellow-billed cuckoo habitat will be designed and managed to provide high habitat values for this species. Created habitat will be dominated by native riparian trees (i.e., cottonwood and willow trees), support a tree structure corresponding to structural types I–III (i.e., the greatest proportion of trees are at least in the 10–20-foot height class), support a diversity of plant species, and be created to the greatest extent practicable in patch sizes optimal for supporting the species. Created habitat, thus, will approximate the condition of the native habitat of the species that was historically present along the LCR.

To ensure that high-quality and fully functioning yellow-billed cuckoo habitat is created, the following design and management criteria, subject to adjustment through the LCR MSCP adaptive management process (Section 5.12.1), will be applied to created cottonwood-willow land cover dedicated as replacement yellow-billed cuckoo habitat.

- Habitat will be created in patches of at least 25 acres, which, at a minimum, is expected to provide suitable nesting habitat for 1–2 pairs. Creation of larger patches are expected to provide sufficient habitat to support multiple nesting pairs.
- Based on studies conducted by Gaines (1974), priority will be given to creating habitat in patches of at least 330 feet in width. Created-habitat patches will be located close to each other or to existing tracts of riparian forest and situated in a manner that will maximize continuity with other riparian land cover types.

- Created habitat will be managed to maintain cottonwood and willow stands with trees in structural types I–III.
- The vegetation and seral structure and edge characteristics described for created southwestern willow flycatcher habitat (Section 5.7.2) will be maintained in created cottonwood-willow land cover that is designed and managed to provide both yellow-billed cuckoo and southwestern willow flycatcher habitat.
- Mounds and depressions will be created in habitat created on conservation areas to establish some topographic diversity that will also provide habitat diversity by increasing plant and insect prey species diversity.

YBCU2—Maintain existing important yellow-billed cuckoo habitat areas. The Applicants, under agreements with cooperating land management agencies, will provide funding to those agencies to maintain a portion of existing yellow-billed cuckoo habitat within the LCR MSCP planning area (Section 5.4.2). Maintaining important existing habitat areas is necessary to ensure the continued existence of the yellow-billed cuckoo in the LCR MSCP planning area, provide for the production of individuals that could disperse to and nest in LCR MSCP–created habitats, and reduce the likelihood of future Federal listing of the species.

5.7.14.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including maintenance of existing important habitat areas and creation of 4,050 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the yellow-billed cuckoo, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. In addition, implementation of the conservation measures will benefit the yellow-billed cuckoo by increasing the amount of new habitat in the LCR MSCP planning area by 2,516 acres, in addition to replacing the extent of affected habitat.

5.7.15 Elf Owl

5.7.15.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 161 acres of elf owl habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 590 acres of habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.15.2 Conservation Measures

ELOW1—Create 1,784 acres of elf owl habitat. Of the 7,260 acres of created cottonwood-willow and honey mesquite land cover, at least 1,784 acres will be designed and created to provide elf owl habitat. Patches of created habitat will be designed and managed to support cottonwood-willow types I and II and honey mesquite type III that provide habitat for this species. The created habitat will be established in patches as large as possible. At a minimum, however, isolated patches of honey mesquite type III will be created in patches of at least 50 acres, and, of the 5,940 acres of LCR MSCP–created cottonwood-willow, 1,702 acres will be created in patches of at least 50 acres, 2,348 acres will be created in patches of at least 25 acres, and 1,890 acres will be created in patches of at least 10 acres. In addition to the spatial replacement of affected habitat, the quality of created habitat will be substantially greater than affected habitats. Patches of existing cottonwood-willow in the LCR MSCP planning area typically include dense stands of saltcedar that support little vegetative diversity relative to the cottonwood-willow land cover that will be created as habitat. Created habitat will be dominated by native riparian trees (i.e., cottonwood and willow trees), support a tree structure corresponding to structural types I and II, support a diversity of plant species, and be created to the greatest extent practicable in patch sizes optimal for supporting the species. The created elf owl habitat will also provide habitat for gilded flickers and Gila woodpeckers that create tree cavities that are used by elf owls for nesting. The design and management criteria described in the conservation measures for the yellow-billed cuckoo (Section 5.7.14) will ensure that created cottonwood-willow stands in structural types I and II will also provide other habitat requirements for this species (e.g., habitat patch size, food requirements). Created habitat, thus, will approximate the condition of the native habitat of the species that was historically present along the LCR. In addition, larger patches of created southwestern willow flycatcher habitat (i.e., greater than 10 acres) that supports cottonwood-willow types I and II could also provide habitat for this species.

ELOW2—Install elf owl nest boxes. Until vegetation has matured sufficiently to attract woodpeckers that are needed to create nesting cavities for the elf owl, structural characteristics of nesting habitat (i.e., snags) will be artificially established. Installation of 2–5 nest boxes on poles or sufficiently tall trees per 250 acres of created habitat will be conducted to replicate the average breeding density of established populations in southwestern United States (Henry and Gehlbach 1999).

5.7.15.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 1,784 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the elf owl, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. In addition, implementation of the conservation measures will

benefit the elf owl by increasing the amount of new habitat in the LCR MSCP planning area by 1,033 acres, in addition to replacing the extent of affected habitat.

5.7.16 Gilded Flicker

5.7.16.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 1,435 acres of gilded flicker habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 99 acres of habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.16.2 Conservation Measures

GIFL1—Create 4,050 acres of gilded flicker habitat. Of the 5,940 acres of created cottonwood-willow, at least 4,050 acres will be designed and created to provide habitat for this species. The 4,050 acres of habitat created for the yellow-billed cuckoo will also provide habitat for the gilded flicker. The created habitat will be established in patches as large as possible but will not be created in patches smaller than 25 acres. In addition to the spatial replacement of affected habitat, the quality of created habitat will be substantially greater than affected habitats. Patches of existing cottonwood-willow in the LCR MSCP planning area typically include dense stands of saltcedar that support little vegetative diversity relative to the cottonwood-willow land cover that will be created as habitat. Created habitat will be dominated by native riparian trees (i.e., cottonwood and willow trees), support a tree structure corresponding to structural types I–III, support a diversity of plant species, and be created to the greatest extent practicable in patch sizes optimal for supporting the species. The design and management criteria described in the conservation measures for the yellow-billed cuckoo (Section 5.7.14) will ensure that created cottonwood-willow stands in structural types I–III will also provide other habitat requirements for this species (e.g., habitat patch size, food requirements). Created habitat, thus, will approximate the condition of the native habitat of the species that was historically present along the LCR. In addition, created southwestern willow flycatcher habitat that supports cottonwood-willow types I–III could also provide habitat for this species.

GIFL2—Install artificial snags to provide gilded flicker nest sites. Until vegetation in created patches of gilded flicker habitat has matured sufficiently to support structural characteristics of nesting habitat (i.e., snags), install artificial snags that can be used by gilded flickers to excavate nesting cavities.

5.7.16.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 4,050 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the gilded flicker, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. In addition, implementation of the conservation measures will benefit the gilded flicker by increasing the amount of new habitat in the LCR MSCP planning area by 2,516 acres, in addition to replacing the extent of affected habitat.

5.7.17 Gila Woodpecker

5.7.17.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 829 acres of Gila woodpecker habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 26 acres of habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.17.2 Conservation Measures

GIWO1—Create 1,702 acres of Gila woodpecker habitat. Of the 5,940 acres of created cottonwood-willow, at least 1,702 acres will be designed and created to provide habitat for this species in Reaches 3–6. Patches of created habitat will be designed and managed to support cottonwood-willow types I–IV in patches as large as possible but will not be created in patches smaller than 50 acres to achieve, based on the best available information, the minimum habitat patch size requirements of the species. In addition to the spatial replacement of affected habitat, the quality of created habitat will be substantially greater than affected habitats. Patches of existing cottonwood-willow in the LCR MSCP planning area typically include dense stands of saltcedar that support little vegetative diversity relative to the cottonwood-willow land cover that will be created as habitat. Created habitat will be dominated by native riparian trees (i.e., cottonwood and willow trees), support a tree structure corresponding to structural types I–IV, support a diversity of plant species, and be created to the greatest extent practicable in patch sizes optimal for supporting the species. The design and management criteria described in the conservation measures for the southwestern willow flycatcher (Section 5.7.2) and yellow-billed cuckoo (Section 5.7.14) will ensure that created cottonwood-willow stands in

structural types I–IV will also provide other habitat requirements for this species (e.g., habitat patch size, food requirements). Created habitat, thus, will approximate the condition of native habitat of the species that was historically present along the LCR.

GIWO2—Install artificial snags to provide Gila woodpecker nest sites. Until vegetation in created patches of Gila woodpecker habitat has matured sufficiently to support structural characteristics of nesting habitat (i.e., snags), install artificial snags that can be used by Gila woodpeckers to excavate nesting cavities.

5.7.17.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 1,702 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Gila woodpecker, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. In addition, implementation of the conservation measures will benefit the Gila woodpecker by increasing the amount of new habitat in the LCR MSCP planning area by 847 acres, in addition to replacing the extent of affected habitat.

5.7.18 Vermilion Flycatcher

5.7.18.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 1,900 acres of vermilion flycatcher habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 714 acres of habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.18.2 Conservation Measures

VEFL1—Create 5,208 acres of vermilion flycatcher habitat. Of the 7,260 acres of created cottonwood-willow and honey mesquite, at least 5,208 acres will be designed and created to provide habitat for this species. Patches of created habitat will be designed and managed to support cottonwood-willow types I–IV and honey mesquite type III that provide habitat for this species. The created habitat will be established in patches as large as possible. At a minimum, however, isolated patches of honey mesquite will be created

in patches of at least 50 acres, and, of the 5,940 acres of LCR MSCP–created cottonwood-willow, 1,702 acres will be created in patches of at least 50 acres, 2,348 acres will be created in patches of at least 25 acres, and 1,890 acres will be created in patches of at least 10 acres. In addition to the spatial replacement of affected habitat, the quality of created habitat will be substantially greater than affected habitats. Patches of existing cottonwood-willow in the LCR MSCP planning area typically include dense stands of saltcedar that support little vegetative diversity relative to the cottonwood-willow land cover that will be created as habitat. Created habitat will be dominated by native riparian trees (i.e., cottonwood and willow trees), support a tree structure corresponding to structural types I–IV, support a diversity of plant species, and be created to the greatest extent practicable in patch sizes optimal for supporting the species. Created habitat, thus, will approximate the condition of the native habitat of the species that was historically present along the LCR. The design and management criteria described in the conservation measures for the southwestern willow flycatcher (Section 5.7.2) and yellow-billed cuckoo (Section 5.7.14) will ensure that created cottonwood-willow stands in structural types I–IV will also provide other habitat requirements for this species (e.g., habitat patch size, food requirements).

5.7.18.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 5,208 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the vermilion flycatcher, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. In addition, implementation of the conservation measures will benefit the vermilion flycatcher by increasing the amount of new habitat in the LCR MSCP planning area by 2,594 acres, in addition to replacing the extent of affected habitat.

5.7.19 Arizona Bell's Vireo

5.7.19.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 1,674 acres of Arizona Bell's vireo habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 1,309 acres of habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.19.2 Conservation Measures

BEVI1—Create 2,983 acres of Arizona Bell's vireo habitat. Of the 7,260 acres of created cottonwood-willow and honey mesquite, at least 2,983 acres will be designed and created to provide habitat for this species. Patches of created habitat will be designed and managed to support cottonwood-willow types III and IV and honey mesquite type III that provide habitat for this species. The created habitat will be established in patches as large as possible. In addition to the spatial replacement of affected habitat, the quality of created habitat will be substantially greater than affected habitats. Patches of existing cottonwood-willow in the LCR MSCP planning area typically include dense stands of saltcedar that support little vegetative diversity relative to the cottonwood-willow land cover that will be created as habitat. Created habitat will be dominated by native riparian trees (i.e., cottonwood and willow trees), support a tree structure corresponding to structural types III–IV, support a diversity of plant species, and will be created to the greatest extent practicable in patch sizes optimal for supporting the species. The design and management criteria described in the conservation measures for the southwestern willow flycatcher (Section 5.7.2) and yellow-billed cuckoo (Section 5.7.14) will ensure that created cottonwood-willow stands in structural types III and IV will also provide other habitat requirements for this species (e.g., habitat patch size, food requirements). In particular, the management of moist surface soil, slow-moving water, or ponded water conditions and greater diversity of seral stages of cottonwood-willow described in the conservation measures for the southwestern willow flycatcher habitat will also provide these habitat requirements for this species. Created habitat, thus, will approximate the condition of the native habitat of the species that was historically present along the LCR.

5.7.19.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 2,983 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Arizona Bell's vireo. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat.

5.7.20 Sonoran Yellow Warbler

5.7.20.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 2,939 acres of Sonoran yellow warbler habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 183 acres of habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however,

the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.20.2 Conservation Measures

YWAR1—Create 4,050 acres of Sonoran yellow warbler habitat. Of the 5,940 acres of created cottonwood-willow, at least 4,050 acres will be designed and created to provide habitat for this species. Patches of created habitat will be designed and managed to support cottonwood-willow types I–IV. The created habitat will be established in patches as large as possible. At a minimum, however, all of the habitat will be created in patches of at least 10 acres, thus, based on the best available information, will meet the minimum habitat patch size requirements of the species. Created riparian forests will support breeding and migration habitats for yellow warblers that migrate along the LCR. In addition, the per-acre quality of created habitat for this species will be substantially greater than that of the affected habitat. Along the LCR, this species formerly nested in cottonwood-willow habitat ranging from gallery forests to early successional stage scrublands.

In addition to the spatial replacement of affected habitat, the quality of created habitat will be substantially greater than affected habitats. Patches of existing cottonwood-willow in the LCR MSCP planning area typically include dense stands of saltcedar that support little vegetative diversity relative to the cottonwood-willow land cover that will be created as habitat. Created habitat will be dominated by native riparian trees (i.e., cottonwood and willow trees), support a tree structure corresponding to structural types I–IV, support a diversity of plant species, and be created to the greatest extent practicable in patch sizes optimal for supporting the species. Created habitat, thus, will approximate the condition of the native habitat of the species that was historically present along the LCR. The design and management criteria described in the conservation measures for the southwestern willow flycatcher (Section 5.7.2) and yellow-billed cuckoo (Section 5.7.14) will ensure that created cottonwood-willow stands in structural types I–IV will also provide other habitat requirements for this species (e.g., habitat patch size, food requirements).

5.7.20.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 4,050 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the Sonoran yellow warbler, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat. In addition, implementation of the conservation measures will benefit the Sonoran yellow warbler by increasing the amount of new habitat in the LCR MSCP planning area by 928 acres, in addition to replacing the extent of affected habitat.

5.7.21 Summer Tanager

5.7.21.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 161 acres of summer tanager habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 14 acres of habitat. Some additional limited and low value habitat (e.g., patches of saltcedar and saltcedar-dominated land cover types) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.21.2 Conservation Measures

SUTA1—Create 602 acres of summer tanager habitat. Of the 5,940 acres of created cottonwood-willow, at least 602 acres will be designed and created to provide habitat for the species. Patches of created habitat will be designed and managed to support cottonwood-willow types I and II. The created habitat will be established in patches as large as possible. At a minimum, however, 4,050 acres of cottonwood-willow will be created in patches of at least 25 acres, and 1,890 acres will be created in patches of at least 10 acres.

In addition to the spatial replacement of affected habitat, the quality of created habitat will be substantially greater than affected habitats. Patches of existing cottonwood-willow in the LCR MSCP planning area typically include dense stands of saltcedar that support little vegetative diversity relative to the cottonwood-willow land cover that will be created as habitat. Created habitat will be dominated by native riparian trees (i.e., cottonwood and willow trees), support a tree structure corresponding to structural types I and II (i.e., over 50 percent of the trees are taller than 15 feet), support a diversity of plant species, and will be created to the greatest extent practicable in patch sizes optimal for supporting the species. Created habitat, thus, will approximate the condition of the native habitat of the species that was historically present along the LCR. The design and management criteria described in the conservation measures for the yellow-billed cuckoo (Section 5.7.14) will ensure that created cottonwood-willow stands in structural types I and II will also provide other habitat requirements for this species (e.g., habitat patch size, food requirements). In addition, created southwestern willow flycatcher habitat that supports cottonwood-willow types I and II could also provide habitat for this species.

5.7.21.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 602 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the summer tanager, and reduce the likelihood of future Federal listing of the species.

Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. In addition, implementation of the conservation measures will benefit the summer tanager by increasing the amount of new habitat in the LCR MSCP planning area by 427 acres, in addition to replacing the extent of affected habitat.

5.7.22 Flat-Tailed Horned Lizard

5.7.22.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures are not expected to affect flat-tailed horned lizard habitat or result in take of individuals. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of 128 acres of species habitat and direct mortality of lizards.

5.7.22.2 Conservation Measures

FTHL1—Acquire and protect 230 acres of existing unprotected occupied flat-tailed horned lizard habitat. Consistent with the mitigation measures identified in the Flat-Tailed Horned Lizard Rangewide Management Strategy (Flat-tailed Horned Lizard Interagency Coordinating Committee 2003), the LCR MSCP will acquire and protect 230 acres of unprotected occupied flat-tailed horned lizard habitat. The acquired habitat will be transferred to an appropriate management agency for permanent protection of habitat for the species.

FTHL2—Implement conservation measures to avoid or minimize take of flat-tailed horned lizard. Reclamation will continue to implement measures to avoid or minimize take of flat-tailed horned lizard. These measures would include worker education programs and other procedures as described in the 1997 BO (U.S. Fish and Wildlife Service 1997) and are in accordance with the 2003 Flat-tailed Horned Lizard Interagency Coordinating Committee recommendations for the species.

5.7.22.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to protect 230 acres unprotected occupied flat-tailed horned lizard habitat achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the flat-tailed horned lizard. Implementation of this measure will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained.

5.7.23 Relict Leopard Frog

5.7.23.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures to create and maintain wetland areas may result in take of the relict leopard frog, restriction of gene flow, and temporary disturbance of habitat.

5.7.23.2 Conservation Measures

RLFR1—Provide funding to support existing relict leopard frog conservation programs. LCR MSCP program activities will assist and contribute to existing relict leopard frog research and conservation programs where appropriate. In particular, the LCR MSCP will contribute $10,000 per year for 10 years to support implementation of planned, but unfunded, conservation measures for the relict leopard frog. To the extent consistent with the LCR MSCP Conservation Plan goals and objectives, implementation of this conservation measure will be coordinated with the Relict Leopard Frog Conservation Team.

5.7.23.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to fund planned, but unfunded, research and conservation measures to be undertaken through existing programs, as appropriate, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the relict leopard frog, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in and adjacent to the LCR MSCP planning area is maintained or increased.

5.7.24 Flannelmouth Sucker

5.7.24.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 85 acres of flannelmouth sucker habitat, stranding and desiccation losses in the river and backwaters, and entrainment of individuals at diversions.

5.7.24.2 Conservation Measures

FLSU1—Create 85 acres of flannelmouth sucker habitat. Of the 360 acres of LCR MSCP–created backwaters, at least 85 acres will be created in Reach 3 with water depth,

vegetation, and substrate characteristics that provide the elements of flannelmouth sucker habitat. Additional habitat could also be provided depending on the extent of connected backwaters that are created for the razorback sucker and bonytail in Reach 3. Created backwaters will be designed and managed as described in Section 5.4.3.4. At a minimum, created backwaters will contain the physical, chemical, and biological conditions suitable for the establishment and maintenance of healthy fish populations in the LCR.

FLSU2—Provide funding to support existing flannelmouth sucker conservation programs. The LCR MSCP will provide $80,000 per year for 5 years ($400,000 total) to support flannelmouth sucker research efforts in Reach 3 below Davis Dam to determine habitat use, habitat preferences, and recruitment and to support decisions on habitat management activities for river channel and backwater habitats in Reach 3.

FLSU3—Assess flannelmouth sucker management needs and develop management strategies. The LCR MSCP will use results of research conducted by the LCR MSCP (see conservation measure FLSU2) and others, through the adaptive management process, to assess main channel and backwater management needs and develop management strategies to benefit the flannelmouth sucker.

5.7.24.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 85 acres of habitat and funding research to determine the management needs of the flannelmouth sucker in the LCR, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the flannelmouth sucker, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of replacing affected habitat and identifying future management activities that could be undertaken by the LCR MSCP or others that will benefit the species.

5.7.25 MacNeill's Sootywing Skipper

5.7.25.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 222 acres of MacNeill's sootywing skipper habitat and take of individuals.

5.7.25.2 Conservation Measures

MNSW1—Conduct surveys and research to locate MacNeill's sootywing skipper habitat and to better define its habitat requirements. Conduct research to locate

MacNeill's sootywing skipper populations that could be affected by covered activities and determine the macrohabitat and microhabitat requirements and ecology of the species. Based on research results, implement adaptive management experiments to develop habitat establishment and management methods.

MNSW2—Create at least 222 acres of MacNeill's sootywing skipper habitat. Based on results of research conducted under conservation measure MNSW1, at least 222 acres of MacNeill's sootywing skipper habitat will be created in Reaches 1–4 near occupied habitat. Patches of created habitat will be designed and managed to support a mix of honey mesquite type III and quail bush to provide food plants for caterpillars and adults and to maintain the microhabitat conditions required by the species. A substantial amount of the 1,320 acres of honey mesquite type III that would be created is expected to be created in reaches occupied by this species and will be established in conjunction with quail bush, the species' larval host plant. Consequently, it is anticipated substantially more than 222 acres of habitat could be created under the LCR MSCP.

5.7.25.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to create 222 acres of MacNeill's sootywing skipper habitat achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the MacNeill's sootywing skipper. Implementation of this measure will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully mitigating the loss of habitat.

5.7.26 Sticky Buckwheat

5.7.26.1 Summary of Effects

Changes in Lake Mead reservoir elevations associated with implementation of flow-related covered activities could result in some low, unquantifiable, level of take of sticky buckwheat plants that have established below the full-pool elevation, when reservoir elevations rise to elevations that inundate plants.

5.7.26.2 Conservation Measures

STBU1—Provide funding to support existing sticky buckwheat conservation programs. The LCR MSCP will provide $10,000 per year until 2030 to the Clark County Multi-Species Habitat Conservation Plan (MSHCP) Rare Plant Workgroup to support implementation of conservation measures for the sticky buckwheat and threecorner milkvetch that are beyond the permit requirements of the Clark County MSHCP.

5.7.26.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to fund planned, but unfunded, conservation measures to be undertaken by the Clark County MSHCP Rare Plant Workgroup achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the sticky buckwheat, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in and adjacent to the LCR MSCP planning area is maintained or increased.

5.7.27 Threecorner Milkvetch

5.7.27.1 Summary of Effects

Changes in Lake Mead reservoir elevations associated with implementation of flow-related covered activities could result in some low, unquantifiable, level of take of threecorner milkvetch plants that have established below the full-pool elevation, when reservoir elevations rise to elevations that inundate plants.

5.7.27.2 Conservation Measures

THMI1—Provide funding to support existing threecorner milkvetch conservation programs. The LCR MSCP will provide $10,000 per year until 2030 to the Clark County MSHCP Rare Plant Workgroup to support implementation of conservation measures for the threecorner milkvetch and sticky buckwheat that are beyond the permit requirements of the Clark County MSHCP.

5.7.27.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measure to fund planned, but unfunded, conservation measures to be undertaken by the Clark County MSHCP Rare Plant Workgroup achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the threecorner milkvetch, and reduce the likelihood of future Federal listing of the species. Implementation of these measures will help ensure that the existing abundance of the species in and adjacent to the LCR MSCP planning area is maintained or increased.

5.8 Evaluation Species Conservation Measures

5.8.1 California Leaf-Nosed Bat

5.8.1.1 Summary of Effects

Implementation of flow-related covered activities could potentially reduce the diversity and abundance of insects that are food for the California leaf-nosed bat.

5.8.1.2 Conservation Measures

CLNB1—Conduct surveys to locate California leaf-nosed bat roost sites. Conduct investigations to identify locations of California leaf-nosed bat roost sites within 5 miles of the LCR MSCP planning area in Reaches 3–5.

CLNB2—Create covered species habitat near California leaf-nosed bat roost sites. The LCR MSCP process for selecting sites to establish cottonwood-willow and honey mesquite as habitat for other covered species will, based on the information collected under conservation measure CLNB1, give priority, when consistent with achieving LCR MSCP goals for other covered species, to selecting sites that are within 5 miles of California leaf-nosed bat roosts in Reaches 3–5. As described in Section 5.4.3, created cottonwood-willow and honey mesquite land cover will be designed to establish stands that will support a substantially greater density and diversity of plant species that are likely to support a greater abundance of insect prey species than is currently produced in the affected land cover types.

5.8.1.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures that will maintain or increase the production of insect food items will fully mitigate flow-related impacts, if any, on the diversity and production of insects. In addition, implementation of survey and research conservation measures will provide important information for use in developing future conservation efforts for this species.

5.8.2 Pale Townsend's Big-Eared Bat

5.8.2.1 Summary of Effects

Implementation of flow-related covered activities could potentially reduce the diversity and abundance of insects that are food for the pale Townsend's big-eared bat.

5.8.2.2 Conservation Measures

PTBB1—Conduct surveys to locate pale Townsend's big-eared bat roost sites. Conduct investigations to identify locations of pale Townsend's big-eared bat roost sites within 10 miles of the LCR MSCP planning area in Reaches 3–5.

PTBB2—Create covered species habitat near pale Townsend's big-eared bat roost sites. The LCR MSCP process for selecting sites to establish cottonwood-willow and honey mesquite as habitat for other covered species will, based on the information collected under conservation measure PTBB1, give priority, when consistent with achieving LCR MSCP goals for other covered species, to selecting sites that are within 10 miles of pale Townsend's big-eared bat roosts in Reaches 3–5. As described in Section 5.4.3, created cottonwood-willow and honey mesquite land cover will be designed to establish stands that will support a substantially greater density and diversity of plant species that are likely to support a greater abundance of insect prey species than is currently produced in the affected land cover types.

5.8.2.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures that will maintain or increase the production of insect food items will fully mitigate flow-related impacts, if any, on the diversity and production of insects. In addition, implementation of survey and research conservation measures will provide important information for use in developing future conservation efforts for this species.

5.8.3 Colorado River Toad

5.8.3.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures will not result in take of the Colorado River toad because it is not known to currently inhabit the LCR MSCP planning area.

5.8.3.2 Conservation Measures

CRTO1—Conduct research to better define the distribution, habitat requirements, and factors that are limiting the distribution of the Colorado River toad. Develop and implement a multiyear integrated research program to determine the range, status, habitat requirements, population biology, factors that currently limit Colorado River toad abundance and distribution, and factors that have contributed to the decline of the species in the LCR MSCP planning area.

CRTO2—Protect existing unprotected occupied Colorado River toad habitat. Based on results of research conducted under conservation measures CRTO1 and within funding constraints of the LCR MSCP, protect existing unprotected occupied Colorado River toad habitat that is located through the research program.

CRTO3—Conduct research to determine feasibility of establishing the Colorado River toad in unoccupied habitat. Conduct research necessary to determine the feasibility for successfully establishing the Colorado River toad in unoccupied habitat. If feasible, implement a pilot introduction into unoccupied habitat, and monitor the success of methods and establishment of the Colorado River toad in unoccupied habitat.

5.8.3.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures to conduct research to determine the species status and life requirements and techniques for reestablishing occurrences of the Colorado River toad will provide information necessary for successful management to maintain and increase the abundance of the Colorado River toad throughout its range.

5.8.4 Lowland Leopard Frog

5.8.4.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures will not result in take of the lowland leopard frog because it is not known to currently inhabit the LCR MSCP planning area.

5.8.4.2 Conservation Measures

LLFR1—Conduct research to better define the distribution, habitat requirements, and factors that are limiting the distribution of the lowland leopard frog. Develop and implement a multiyear integrated research program to determine the range, status, habitat requirements, population biology, factors that currently limit lowland leopard frog abundance and distribution, and factors that have contributed to the decline of the species in the LCR MSCP planning area.

LLFR2—Protect existing unprotected occupied lowland leopard frog habitat. Based on results of research conducted under conservation measures LLFRO1 and within funding constraints of the LCR MSCP, protect existing unprotected occupied lowland leopard frog habitat that is located through the research program.

LLFR3—Conduct research to determine feasibility of establishing the lowland leopard frog in unoccupied habitat. Conduct research necessary to determine the feasibility for successfully establishing the lowland leopard frog in unoccupied habitat. If

feasible, implement a pilot introduction into unoccupied habitat, and monitor the success of methods and establishment of the lowland leopard frog in unoccupied habitat.

5.8.4.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures to conduct research to determine the status and life requirements and techniques for reestablishing occurrences of the lowland leopard frog will provide information necessary for successful management to maintain and increase the abundance of lowland leopard frogs throughout its range.

5.9 Summary of Conservation Plan Elements that Minimize and Mitigate Effects to the Maximum Extent Practicable

The Conservation Plan is designed to fully mitigate adverse effects on all and contributes to the recovery of most covered species resulting from covered activities described in Chapter 2. In doing so, the LCR MSCP Conservation Plan meets the ESA section 10 standard to minimize and mitigate the impacts of the covered activities on covered species to the maximum extent practicable (50 C.F.R. §17.22(b)(2)(B)). This section describes how the Conservation Plan minimizes and mitigates, to the maximum extent practicable, impacts of the covered activities and the LCR MSCP implementation on the covered species. As described in Sections 5.3–5.7, the LCR MSCP Conservation Plan includes conservation measures to avoid and minimize effects of covered activities and habitat creation measures to fully replace affected covered species habitats.

Except for implementing the avoidance and minimization conservation measures, it is not considered practicable to further modify the proposed covered activities to reduce the level of potential impacts on covered species. As described in Chapter 9, the ability to modify operations to reduce the level of take is constrained by the Law of the River, and alternatives to changing points of diversions would likely be cost prohibitive and would potentially result in impacts on ESA-listed species in the modified action area. There also are no practical alternatives, other than implementing the LCR MSCP Conservation Plan minimization measures, to implementing covered activities that are necessary to maintain infrastructure (e.g., canals, drains, levees, channels, roads).

The LCR MSCP minimizes and fully mitigates effects on covered species using the following combined strategies:

- maintain a portion of important existing habitat for covered species in the LCR MSCP planning area that otherwise would degrade over time without management intervention;

- create habitat to establish new habitat in quantities equal to or greater than the extent of affected habitats, including management of created habitat to maintain and preserve ecological functions over the term of the LCR MSCP;
- avoid and minimize impacts on covered species and their habitat that could result from covered activities and LCR MSCP implementation;
- implement population enhancement measures that directly or indirectly increase abundance of covered species; and
- conduct monitoring and research necessary to assess and improve conservation measure effectiveness and adaptively manage implementation of the LCR MSCP Conservation Plan over time.

As described in Section 5.4.3, the LCR MSCP Conservation Plan provides for creation of:

- 5,940 acres of cotton-willow land cover designed and managed to replace and provide greater habitat value for associated covered species than the 2,132 acres of cottonwood-willow land cover affected by covered activities;
- 1,320 acres of honey mesquite land cover designed and managed to replace and provide greater habitat value for associated covered species than the up to 1,200 acres of honey mesquite land cover that could be affected by covered activities;
- 512 acres of marsh land cover designed and managed to replace and provide greater habitat value for associated covered species than the 243 acres of marsh land cover affected by covered activities; and
- 360 acres of backwaters designed to provide greater habitat value for associated covered species than the 399 acres of backwaters and river channel affected by covered activities.

In addition to replacing affected habitat, habitat created under the LCR MSCP Conservation Plan is expected to provide substantially greater habitat values for covered species than the affected habitats because:

- Saltcedar is currently the dominant vegetation in the LCR MSCP planning area, and native habitats are generally fragmented and in a degraded condition (e.g., remnant cottonwood-willow stands generally support few native trees and are dominated by saltcedar). To the extent practicable based on site conditions, cottonwood-willow, honey mesquite, marsh, and backwaters will be created in proximity to each other and in large blocks to recreate integrated mosaics of habitat that approximate the relationship among aquatic and terrestrial communities historically present along the LCR floodplain. In addition, created habitats will be designed and managed to be dominated by native vegetation.
- The LCR MSCP Conservation Plan includes a commitment to actively manage created habitats over the term of the LCR MSCP to ensure high habitat values are maintained (e.g., control of saltcedar, irrigation to maintain created habitats, implementing actions to reduce the risk of loss to wild fire or other destructive events), whereas most of the remaining native habitats in the LCR MSCP planning

area are not managed to maintain or increase habitat values and typically are not protected from loss to wild fires.

- As described in Section 5.5, to the extent practicable, created habitats will be located near existing occupied habitats to create larger blocks of habitat, thereby increasing the overall value of both the created and existing habitats, and increase the likelihood for rapid occupancy of created habitats by covered species.

In addition, the Conservation Plan includes a substantial commitment to conduct monitoring and research that provides the information necessary to adaptively manage Conservation Plan implementation and maximize benefits for covered species over the term of the LCR MSCP.

The following sections describe how conservation measures, to the maximum extent practicable, will minimize and mitigate effects of the covered activities and the LCR MSCP implementation on species groups.

5.9.1 Covered Mammal Species

The LCR MSCP Conservation Plan will create at least 1 acre of habitat for every acre of habitat affected by covered activities (Table 5-11). The ecology of the covered mammal species, factors that are limiting these species, and/or these species' microhabitat requirements are not well understood. The LCR MSCP Conservation Plan, in addition to fully mitigating the effects of habitat loss, however, includes conservation measures to undertake monitoring and research to address these uncertainties and provide information necessary for future beneficial management of these species.

5.9.2 Covered Bird Species

The LCR MSCP Conservation Plan will create at least 1 acre of Arizona Bell's vireo and the Sonoran yellow warbler habitat for every acre of habitat affected by covered activities and will create 2.0–3.4 acres of habitat to replace the habitat of the other covered bird species (Table 5-11). As described in Section 5.6.2, the LCR MSCP Conservation Plan also includes MRMs for covered bird species to provide the information necessary to adaptively manage its implementation and to maximize benefits of the Conservation Plan for these species over the term of the LCR MSCP. Other conservation measures that minimize and avoid impacts on covered birds species include:

- Establishing a $25 million fund contribution that will be used to maintain or increase the value of existing important southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and California black rail habitat over the term of the LCR MSCP. Although this conservation measure is directed specifically toward benefiting these species, other covered species that use these maintained habitats would also benefit.
- Avoiding affects on existing habitats at Topock Marsh by implementing actions to maintain the existing levels of water deliveries to Topock Marsh, thus avoiding impacts on habitat for 10 covered bird species, including 2,135 acres of southwestern

willow flycatcher habitat (the largest contiguous block of species habitat in the LCR MSCP planning area) and 2,224 acres of Sonoran yellow warbler habitat.

- Avoiding, to the extent practicable, implementing covered activities in covered bird species habitats during the breeding season to minimize potential adverse effects on nesting success, eggs, and juvenile birds. This conservation measure reduces the risk of effects on individuals as much as practicable without precluding the ability to implement the covered activities.

The conservation measures described above that apply to the southwestern willow flycatcher and Yuma clapper rail are designed to contribute to attaining the recovery goals identified in the *Final Southwestern Willow Flycatcher Recovery Plan* (U.S. Fish and Wildlife Service 2002b) and the *Yuma Clapper Rail Recovery Plan* (U.S. Fish and Wildlife Service 1983) that apply to the LCR MSCP planning area. The southwestern willow flycatcher recovery goal for the Lower Colorado Recovery Unit is the establishment of at least 525 nesting territories, and the recovery goal for the Yuma clapper rail is to protect sufficient wintering and breeding habitat to support a population of 700–1,000 breeding birds in the United States. The LCR MSCP will substantially contribute to these goals by:

- creating 2,207 acres of additional habitat specifically managed for the southwestern willow flycatcher in the LCR MSCP planning area;
- creating 269 acres of additional habitat specifically managed for the Yuma clapper rail in the LCR MSCP planning area; and
- providing funding to maintain existing protected occupied southwestern willow flycatcher and Yuma clapper rail habitats that are likely to become degraded in the future without management intervention and conservation measures.

5.9.3 Covered Fish Species

The LCR MSCP Conservation Plan will create 1 acre of backwater to provide flannelmouth sucker habitat and 0.9 acre to provide bonytail and razorback sucker habitat for every acre of backwater and river channel affected by covered activities (Table 5-11). Created backwaters will be managed specifically to support the habitat elements for these species and, therefore, are expected to provide substantially greater habitat value than the affected unmanaged habitat. In addition, nonnative fish would be excluded from created disconnected backwaters to eliminate the adverse effects of competition and predation by nonnative species on the covered fish species. This level of habitat mitigation, while not fully replacing the acreage of lost habitat, will provide for some of the replacement habitats to be isolated and free of nonnative fish that are the primary threat to the covered fish species.

In addition to replacement of bonytail and razorback sucker habitat, the LCR MSCP provides for stocking up to 620,000 subadult bonytail and 660,000 subadult razorback sucker to augment existing populations in the LCR MSCP planning area. These population augmentations will provide the nucleus for stable populations, reverse the declining trend in existing abundance, create opportunities for subsequent species research and management, provide significant benefits related to the effects of the

covered activities, and contribute to addressing other threats. The LCR MSCP also provides for contributing $400,000, in addition to replacement of existing flannelmouth habitat, to determine flannelmouth sucker habitat use, habitat preferences, and recruitment and to support decisions on habitat management activities for river channel and backwater habitats in Reach 3.

The LCR MSCP will provide for contributing $500,000 to the Glen Canyon Dam Adaptive Management Program or other entity approved by the USFWS to support implementation of planned, but unfunded, humpback chub conservation measures and, as appropriate, to fund humpback chub conservation measures in the lower Grand Canyon of the Colorado River upstream of Lake Mead NRA. The humpback chub population in Grand Canyon may use the riverine habitat created at the upper end of Lake Mead when water levels in the lake are low. These transitory habitats are created and destroyed based on changes to lake elevations with no permanent loss anticipated. There are no practicable minimization or avoidance measures or ways to replace the habitat within the full pool elevation of Lake Mead. Contributions to the approved humpback chub conservation program will provide for habitat establishment and research opportunities for the Grand Canyon population of the species.

The conservation measures described above for the bonytail, razorback sucker, and humpback chub are designed to contribute to attaining the recovery goals identified in the *Bonytail* (Gila elegans) *Recovery Goals: Amendment and Supplement to the Bonytail Recovery Plan* (U.S. Fish and Wildlife Service 2002c), *Razorback Sucker* (Xyrauchen texanus) *Recovery Goals: Amendment and Supplement to the Razorback Sucker Recovery Plan* (U.S. Fish and Wildlife Service 2002e), and *Humpback Chub* (Gila cypha) *Recovery Goals: Amendment and Supplement to the Humpback Chub Recovery Plan* (U.S. Fish and Wildlife Service 2002d). The goals for the bonytail and razorback sucker relevant to the LCR MSCP planning area are to (1) prevent their extinction, (2) establish and maintain a genetic refugium for each species, and (3) establish two self-sustaining populations of each species. The LCR MSCP will substantially contribute to attaining these goals by stocking large numbers of bonytail and razorback sucker into the LCR and conducting long-term monitoring and research related to their ecology and habitat requirements to obtain information necessary to direct future management activities. The humpback chub could occur in the LCR MSCP only in transitory river segments that may form when Lake Mead is below full pool elevation. Consequently, the LCR MSCP is providing funding for ongoing humpback chub conservation efforts that will help attain its recovery goals upstream of Lake Mead.

5.9.4 Other Covered Species

The LCR MSCP provides for mitigating the effects of covered activities on 192 acres of desert tortoise and 128 acres of flat-tailed horned lizard habitat by protecting 230 acres of unprotected occupied desert tortoise habitat and 230 acres of unprotected occupied flat-tailed horned lizard habitat. This level of mitigation is considered appropriate and is consistent with mitigation recommended in the document “Compensation for Desert Tortoise” (Desert Tortoise Conservation Team 1991) and the Flat-Tailed Horned Lizard Rangewide Management Strategy (Flat-tailed Horned Lizard Interagency Coordinating Committee 2003). In addition, to avoid and minimize impacts on individual desert

tortoises, the LCR MSCP Conservation Plan requires implementation of AMMs derived from USFWS's *Field Survey Protocol for Any Federal Action That May Occur within the Range of the Desert Tortoise* (U.S. Fish and Wildlife Service 1992) and the Desert Tortoise Council's *Guidelines for Handling Desert Tortoises during Construction Projects* (Desert Tortoise Council 1994). Reclamation will also continue to implement measures to avoid or minimize take of flat-tailed horned lizard that are consistent with measures identified in the 1997 BO (U.S. Fish and Wildlife Service 1997) and the Flat-tailed Horned Lizard Rangewide Management Strategy (Flat-tailed Horned Lizard Interagency Coordinating Committee 2003).

LCR MSCP will assist and contribute to existing relict leopard frog research and conservation programs where appropriate, including contributing $100,000 to support implementation of planned, but unfunded, conservation measures for the relict leopard frog. Implementation of covered activities and LCR MSCP conservation measures will not result in permanent loss of relict leopard frog habitat, but could result in take of individuals associated with measures to create and maintain wetland areas. Changes in flow releases from Hoover Dam associated with implementation of flow-related covered activities could disrupt use of the LCR as a frog movement corridor (e.g., amount of flow). Effects of the covered activities cannot reasonably be mitigated within the LCR MSCP planning area, and AMMs are not practicable.

The LCR MSCP Conservation Plan will create at least 1 acre of MacNiell's sootywing skipper habitat for every acre of habitat affected by covered activities (Table 5-11). The ecology of this species, factors that are limiting to it, and its microhabitat requirements are not well understood. Consequently, the LCR MSCP, in addition to mitigating the effects of habitat loss, also includes conservation measures to undertake monitoring and research to address these uncertainties and provide information necessary for future beneficial management of MacNiell's sootywing skipper.

The LCR MSCP will provide $10,000 per year until 2030 to the Clark County MSHCP Rare Plant Workgroup to support implementation of planned, but unfunded, species conservation measures for the sticky buckwheat and threecorner milkvetch. Changes in Lake Mead reservoir elevations associated with implementation of flow-related covered activities could result in some low, unquantifiable, level of impact on sticky buckwheat and threecorner milkvetch plants that have established below the full-pool elevation, when reservoir elevations rise to elevations that inundate plants. This effect cannot reasonably be avoided or minimized; consequently, supporting funding for approved conservation programs within the LCR MSCP planning area is considered appropriate mitigation.

5.10 Timing of Implementing Conservation Measures

The Applicants intend to implement LCR MSCP conservation measures as quickly as efficient staffing, funding, and the time required to conduct necessary research relative to creating covered species habitats and required to evaluate and acquire lands that are suitable for creating covered species habitat will permit. It is not certain when future

flow-related activities (i.e., changes in points of diversion) will be implemented or whether all of these activities will be implemented. It is anticipated, however, that changes in points of diversion will not be implemented for several years following approval of the HCP. Because of the uncertainties surrounding species requirements, habitat creation techniques, and the capabilities of potential habitat creation sites to provide habitat, the LCR MSCP anticipates that the first few years of LCR MSCP implementation will focus on conducting research and adaptive management experiments (e.g., pilot habitat creation projects to test habitat creation techniques) to collect information necessary to successfully implement the LCR MSCP. Following collection of this information, implementation of the LCR MSCP is expected to rapidly accelerate, with most or all of the habitat creation conservation component of the LCR MSCP completed within 20–30 years of HCP approval. All created habitat, however, could be implemented earlier if efficient techniques for establishing habitats are identified through monitoring and research conducted in the first few years of implementation.

The anticipated implementation strategy for establishing cottonwood-willow, honey mesquite, and marsh land cover types to create habitats for associated covered species builds on information that will be gathered in the first few years of LCR MSCP implementation. It is presumed that during implementation Years 0–5, most habitat creation projects will be small in scale and designed to identify and verify the most cost effective means of creating high quality habitat. Larger scale projects would be implemented in Years 6–10 that are designed based on information gathered from previous plantings and partnerships with willing landowners. Implementation Years 11–30 will focus on large-scale habitat creation projects until the habitat creation objective acreage is achieved. The strategy for creation of both connected and disconnected backwaters assumes 60 acres of backwater will be created during each 4-year implementation period, with a goal of creating several small or one or two larger backwaters during any single year. Performance criteria for covered species habitats (Table 5-3) will be used to determine the extent of created cottonwood-willow, honey mesquite, marsh, and backwater that develops as habitat for covered species.

Tables 5-12a–d describe the proposed implementation rate and interim acreage goals for establishment of created habitats.

Table 5-12a. Anticipated Schedule for Establishment of Cottonwood/Willow

Years	Acres/Year	5-Year Total	Cumulative Total
1–5	50	250	250
6–10	150	750	1,000
11–15	300	1,500	2,500
16–20	300	1,500	4,000
21–25	300	1,500	5,500
26–30	–	440	5,940

Table 5-12b. Anticipated Schedule for Establishment of Honey Mesquite

Years	Acres/Year	5-Year Total	Cumulative Total
1–5	20	100	100
6–10	40	200	300
11–15	80	400	700
16–20	80	400	1,100
21–25	–	220	1,320
26–30	–	–	1,320

Table 5-12c. Anticipated Schedule for Establishment of Marsh

Years	Acres/Year	5-Year Total	Cumulative Total
1–5	10	50	50
6–10	20	100	150
11–15	40	200	350
16–20	40[a]	162	512
21–25	–	–	–
26–30	–	–	–

[a] Forty-two acres in year 16 and 40 acres per year in years 17–19.

Table 5-12d. Anticipated Schedule for Establishment of Backwaters

Years	Acres/Year	5-Year Total	Cumulative Total
1–5	15	60	60
6–10	15	60	120
11–15	15	60	180
16–20	15	60	240
21–25	15	60	300
26–30	15	60	360

5.11 Monitoring and Research

The implementing regulations for an HCP (50 C.F.R. §§17.22, 17.32, and 222.307) require a monitoring plan. The USFWS HCP Handbook includes general guidance on the components to be included in the monitoring plan included in an HCP. Additionally,

the USFWS "Five-Point Policy Guidance," published in the *Federal Register* on June 1, 2000 (65 FR 106, 35242–35257) states:

> The monitoring program will be based on sound science. Standard survey or other previously-established monitoring protocols should be used. Although the specific methods used to gather necessary data may differ depending on the species and habitat types, monitoring programs should use a multi-species approach when appropriate.

According to the USFWS, *monitoring* is a mandatory element of all HCPs. When the monitoring program is properly designed and implemented, the monitoring program for an HCP should provide information and data necessary to assess compliance and project impacts, as well as verify progress toward achievement of biological or ecological goals and objectives (65 FR 106:35253). Further, the USFWS states that monitoring approaches that are consistent with the HCP Handbook and addendum should be adequate for assessing whether the HCP is achieving its biological goals and objectives (65 FR 106:35246). The USFWS addendum further clarifies the HCP Handbook's monitoring policy by organizing the types of monitoring into three major elements, including: (1) compliance monitoring; (2) effects and effectiveness monitoring; and (3) monitoring to provide feedback for the adaptive management program.

Compliance monitoring is used to ensure that the HCP permittee is carrying out the terms of the HCP, incidental take permit, and implementation agreement, if used. The effects and effectiveness monitoring is intended to evaluate the effects of the permitted activity (i.e., covered projects) and determine whether the effectiveness of the conservation strategy of the HCP is consistent with the assumptions and predictions when the HCP was developed and approved (65 FR 106:35253).

The Five-Point Policy recommends that the effects and effectiveness monitoring should include the following:

- periodic accounting of incidental take that occurred in conjunction with the permitted activity;
- surveys to determine species status, appropriately measured for the HCP's conservation strategy (e.g., species presence, density, reproductive rates, etc.);
- assessments of habitat condition;
- progress reports related to implementation of the conservation strategy (e.g., acres of habitat created, acres acquired); and
- evaluations of the conservation strategy's success toward meeting the stated biological and ecological goals and objectives.

Finally, the USFWS recommends that permittees develop regular reports that describe and detail the results of the various monitoring program components related to the implementation of the HCP. The HCP, incidental take permit, or implementation agreement should specify the level of detail and quantification required in the monitoring report, as well as the frequency of reporting. Most monitoring programs require reports annually. The Five-Point Policy lists information generally needed in an annual monitoring report, including:

- biological goals and objectives of the HCP (which may need to be reported only once);
- objectives for the monitoring program (which may only need to be reported once);
- location of sampling sites;
- methods for data collection and variables measured;
- frequency, timing, and duration of sampling for the variables;
- description of the data analyses and who conducted the analyses; and
- evaluation of progress toward achieving measurable biological goals and objectives and other terms and conditions as required by the incidental take permit and the implementation agreement.

In the context of the USFWS HCP Handbook and the Five-Point Policy, a significant element of the LCR MSCP includes the implementation of a robust monitoring and research program to provide the information necessary to adaptively manage LCR MSCP implementation of conservation measures in accordance with the adaptive management process (Section 5.12) and to document successful implementation of the conservation measures. Generally, the elements of the monitoring and research program include: (1) system monitoring, (2) species monitoring and research, (3) habitat creation technology research, and (4) post-development or post-habitat creation monitoring.

The Program Manager, in cooperation with the USFWS, will direct development and implementation of the monitoring and research program. The LCR MSCP will maintain databases for storage and retrieval of monitoring and research data collected under the LCR MSCP and by others that are relevant to LCR MSCP covered species and their habitats, as well as for tracking implementation and success of LCR MSCP conservation measures. Monitoring and research will primarily be directed to fill known data and information gaps and/or those data needs identified through database review. Every attempt will be made to use and glean data from existing, ongoing programs and to direct the collection of data that would augment, not replace, these programs. Monitoring protocols and research studies will be designed to avoid excessive disturbance to covered species and to ensure that monitoring and research are conducted in compliance with all permit stipulations.

A very important function of the Program Manager will be to maintain close coordination with other recovery implementation programs and habitat conservation programs in the Colorado River watershed, including the Upper Colorado River Endangered Fish Recovery Program, the Glen Canyon Dam Adaptive Management Program, the Clark County MSHCP, and others that may develop through the life of the LCR MSCP. Additionally, communication and coordination will be maintained with other species conservation planning and habitat creation efforts that are in place within the range of the species covered under the LCR MSCP (e.g., southwestern willow flycatcher research and habitat creation activities along the middle Rio Grande in central New Mexico).

The purpose behind this close communication and coordination is to ensure and facilitate the transfer and management of data and information related to key species and the employment of state-of-the-art habitat creation technologies. LCR MSCP monitoring protocols will be developed in coordination with the National Fish and Wildlife

Foundation's Partner's in Flight programs in Arizona, California, and Nevada to ensure that results of LCR MSCP monitoring are compatible with and can be integrated with data collected on covered species and habitat creation efforts under these programs. This coordination will allow for comparable data to be collected that can be used to better evaluate the regional status and trends of species and to identify and direct future management efforts to benefit these species. Identification of such regional management needs based on coordinated regional monitoring efforts will not only help guide adaptive implementation of the LCR MSCP but will also provide such guidance for other species conservation programs. Additionally, monitoring protocols will be designed and developed that permit coordinated database management, as well as database compatibility with other conservation planning efforts (e.g., databases developed, maintained, and managed in the Glen Canyon Dam Adaptive Management Program, Upper Colorado River Basin Recovery Implementation Program, Roosevelt Lake Habitat Conservation Plan).

5.11.1 System Monitoring

System monitoring will be conducted to collect data on existing populations and habitats of covered species to determine their status, distribution, density, migration, productivity, and other ecologically important parameters. System monitoring will be implemented annually, with decreasing intensity over the term of the LCR MSCP. Collected data will be maintained in a GIS database (e.g., distribution of habitats, species observations) and other database formats as appropriate.

In the early years of LCR MSCP implementation, extensive data gathering will be conducted to acquire and sort data on covered species to identify data gaps and research questions that will be addressed through the adaptive management process. At the same time, ongoing monitoring of endangered species by Reclamation will continue. Additionally, productivity and survival for other avian species will be gathered through continued monitoring at two data Monitor Avian Productivity and Survival (MAPS) stations located in patches of riparian land cover along the LCR (one on created habitat and one on existing habitat that will not be affected by covered activities). If the appropriate sites are identified and become available for use, it may be feasible to establish one or more additional MAPS stations within the LCR MSCP planning area.

As data gaps are identified, monitoring activities, primarily directed toward covered species for which little is known from the LCR (i.e., mammals, amphibians, insects) will be designed, scheduled, and implemented. Monitoring data will itself be reviewed to determine species-specific and habitat creation–specific research needs. For example, the status and distribution of the Colorado River cotton rat is unknown. (None have been seen or collected for a few years.) Small mammal trapping will need to be implemented in areas previously known to be occupied by this species. If the species is located, species-specific research studies will need to be undertaken to determine the relationship between the organism and its environment. Data collected through such species-specific research efforts will then be used to refine or modify LCR MSCP conservation measures to ensure the species' LCR MSCP conservation goals are achieved.

An important aspect of system monitoring includes the development and use of consistent monitoring and research protocols. Monitoring and research plan designs and database management techniques and methodologies should, to the maximum extent practicable, conform to protocols identified or developed in existing species recovery plans, Partner's in Flight bird conservation plans, and other species-related conservation planning efforts.

It is anticipated that system monitoring could decrease during the later years of LCR MSCP implementation because postdevelopment monitoring (Section 5.11.4) on created sites will provide the data necessary to evaluate the overall health and well-being of these species.

5.11.2 Species Research

The LCR MSCP participants recognize that there are considerable data gaps for many of the covered species and that these data are needed to guide, through the adaptive management process, the design and implementation of effective conservation measures. Through the adaptive management process, LCR MSCP implementation will be informed and enhanced by the collection of basic life history data, such as food habits, migration timing, and the physical-, chemical-, and biological-limiting factors necessary to design, construct, and manage the requisite habitats necessary to ensure the continued survival of the species.

A primary example of a life history data gap is the paucity of information about the food habitats of some covered species. What type of food, how much of it, and when must it be available are unanswered questions for species such as the southwestern willow flycatcher and yellow-billed cuckoo—yet this information is needed if the LCR MSCP intends to create habitat for these species that "will support a greater abundance of insect prey production" than their affected habitats.

The Program Manager will determine, in cooperation with USFWS, the appropriate scope of these species-specific research programs and activities. As described for system monitoring, the LCR MSCP will coordinate with, participate in, and build on extant research for these species. Some of the species research items currently identified include brown-headed cowbird and starling control, bat roost and forage site identification, MacNeill's sootywing skipper habitat requirements, and flannelmouth sucker investigations below Davis Dam.

5.11.3 Restoration Research

Restoration technology and methodology research is a key element for successful implementation of habitat creation through the adaptive management process. Most of the habitats to be created under the LCR MSCP involve a continuation, completion, or expansion of activities currently being tested and implemented by Reclamation as part of previous BOs (e.g., some Reclamation projects, such as backwater development, have been implemented as mitigation as long as 30 years ago). Many of Reclamation's ongoing restoration projects are demonstration projects that were designed and implemented to answer some of the multitude of questions surrounding creation of native

aquatic, marsh, and riparian communities in the Colorado River floodplain. Much of this work will still be under investigation as the LCR MSCP moves into the implementation phase. In many ways, these activities are still conceptual in nature.

Basic research on such habitat creation–related activities as seed collection and dispersal, irrigation techniques, and soil conditioning techniques is needed early in the implementation of the LCR MSCP. These data, along with "how-to" information needed to physically create habitat, such as equipment needs, use, and storage, will allow for development of guidelines for implementing habitat creation projects to ensure that BMPs are the rule, not the exception. Examples of these technical how-to questions include:

- Can low-head rock weirs be used to raise water surface elevations in the surrounding floodplain?
- Can backwaters be constructed and protected to induce efficient production of native endangered fishes and yet still be connected to the mainstream to facilitate successful repatriation of larger fish into the aquatic system?
- Can the same type of earth-moving machinery be used to perform work around swales and sloughs as would be used on level ground?
- How are sprinkler pipe systems installed, maintained, and operated on newly seeded areas that exhibit undulating topography?
- How is heavy equipment mobilized into the center of a 40-acre marsh with soft bottoms and 12 inches of standing water?

These are a few of the questions regarding implementation techniques. The habitat creation research studies will be developed through the Program Manager in cooperation with the USFWS.

Initially, a major focus of habitat creation research will be to conduct site evaluations to collect the information necessary to select conservation areas based on the conservation area site-selection criteria (Section 5.5.1). Substantial pre-habitat creation evaluation and inventory will be required to ensure that the best sites are selected.

5.11.4 Postdevelopment Monitoring

Following completion of habitat creation activities (e.g., site grading, plant installation) at each conservation area, postdevelopment monitoring will be conducted to evaluate development of the site as covered species habitat (e.g., growth of vegetation, development of elements of species habitat) and use of the habitat by covered species. Data collected about how created habitat develops relative to the habitat creation techniques used to establish and maintain the habitat will be used to refine management techniques to ensure the most cost-effective approaches are used (e.g., water management). An element of postdevelopment monitoring also includes monitoring of the parameters established for created covered species habitats to determine whether the minimum habitat requirements established for each species' habitat are being achieved (Section 5.11.6).

5.11.5 Monitoring and Research Reporting

The Program Manager will prepare and annually submit to the USFWS a report describing monitoring and research activities undertaken during the previous year, results and analyses of the monitoring and research data, assessment of the effectiveness of conservation measures, and other applicable information required under the Five-Point Policy (Chapter 6, "Governance and Implementation Structure").

5.11.6 Minimum Habitat Creation Requirements of LCR MSCP Conservation Plan

The LCR MSCP has established minimum requirements that define the successful establishment of created habitat for each covered species. These minimum habitat requirements are listed in Table 5-3 and should be achieved to comply with the terms and conditions of the section 10 incidental take permit. Failure to achieve these minimum requirements elements could require implementation of the remedial measures described in Section 5.12.3, "Changed Circumstances and Remedial Measures." Alternative/modified requirements may be developed based on results of monitoring and research through the adaptive management process, with approval of the USFWS.

Monitoring will be conducted as described in Section 5.11.4, "Postdevelopment Monitoring," to determine whether the minimum habitat requirements for covered species are achieved by LCR MSCP created land cover types. Conformance with the commitments for fish augmentations and for funding of species conservation measures under other conservation programs described in Section 5.7, "Species-Specific Conservation Measures," will be tracked as part of maintaining the LCR MSCP implementation database.

5.12 Adaptive Management

The LCR MSCP describes a habitat-based approach for ensuring that mitigation is provided to offset the potential adverse effects of covered activities and LCR MSCP conservation measure implementation on all covered species and for contributing to the recovery of some LCR MSCP species over the 50-year term of the LCR MSCP. Uncertainty is an unavoidable component of creating and managing species habitats. To address such uncertainties, the Program Manager will implement the LCR MSCP based on the principles of adaptive management, which allow LCR MSCP conservation measures to be adjusted over time based on results of monitoring and research. This approach provides a greater measure of certainty that LCR MSCP goals for covered species are achieved over the long-term.

According to Kershner (1997):

> Adaptive management is the process whereby management is initiated, evaluated, and refined (Holling 1978; Walters 1986). It differs from traditional management by recognizing and preparing for the uncertainty that underlies resource management

> decisions. Adaptive management is typically incremental in that it uses information from monitoring and research to continually evaluate and modify management practices. It promotes long-term objectives for ecosystem management and recognizes that the ability to predict results is limited by knowledge of the system. Adaptive management uses information gained from past management experiences to evaluate both success and failure, and to explore new management options.

The USFWS's Five-Point Policy for HCPs (65 FR 106, June 1, 2000) defines adaptive management:

> broadly as a method for examining alternative strategies for meeting measurable biological goals and objectives, and then if necessary, adjusting future conservation management actions according to what is learned.

The LCR MSCP adaptive management process described in this section is intended to be consistent with this definition.

5.12.1 LCR MSCP Adaptive Management Process

Based on the best scientific and commercial information currently available, the Applicants believe the LCR MSCP conservation measures will effectively achieve the LCR MSCP covered species goals. However, conditions within the LCR MSCP planning area, existing habitat conditions, and status of covered species may change during the term of the LCR MSCP. In addition, it is possible that additional and different conservation measures, not contained within the LCR MSCP, will be suggested and proven to be more effective in achieving LCR MSCP covered species goals than those currently identified for LCR MSCP implementation. Finally, it may be found that the LCR MSCP conservation measures prove to be less effective in achieving LCR MSCP covered species goals than anticipated. Activities considered for implementation under the LCR MSCP adaptive management process, however, should not have impacts beyond those considered during the review and permitting process for the LCR MSCP Conservation Plan. To address these uncertainties, the LCR MSCP includes implementation of an adaptive management process to:

- gauge, in cooperation with the USFWS, the effectiveness of existing conservation measures;
- propose alternative or modified conservation measures, as the need arises; and
- address changed and unforeseen circumstances.

The adaptive management process will be administered by the Program Manager (Chapter 6, "Governance and Implementation Structure"), with input from the LCR MSCP Steering Committee, and will provide the Program Manager with objective scientific data and analyses on which to base management decisions.

This adaptive management process will also provide for professional, scientific reviews to evaluate the effectiveness of existing or proposed conservation measures, and the Program Manager will incorporate this review where appropriate. It is also intended that the adaptive management process will provide the basis for budget and funding decisions

throughout the term of the LCR MSCP. Figure 5-4 conceptually illustrates the LCR MSCP adaptive management process. Adaptive management, in conjunction with aggressive monitoring and research (described in Section 5.11), will provide the Program Manager with a process to effectively address uncertainties associated with successful implementation of the LCR MSCP.

The LCR MSCP adaptive management process is intended to be a flexible, iterative approach to long-term habitat creation and management of biological resources and will be influenced over time by the results of ongoing monitoring, research, and other sources of information. Conservation measures, habitat creation activities, and resource management techniques will be regularly evaluated in light of monitoring and research results regarding species needs, habitat creation successes and failures, and other factors. The intent of this evaluation process is to better achieve overall conservation and management goals as defined by measurable biological objectives.

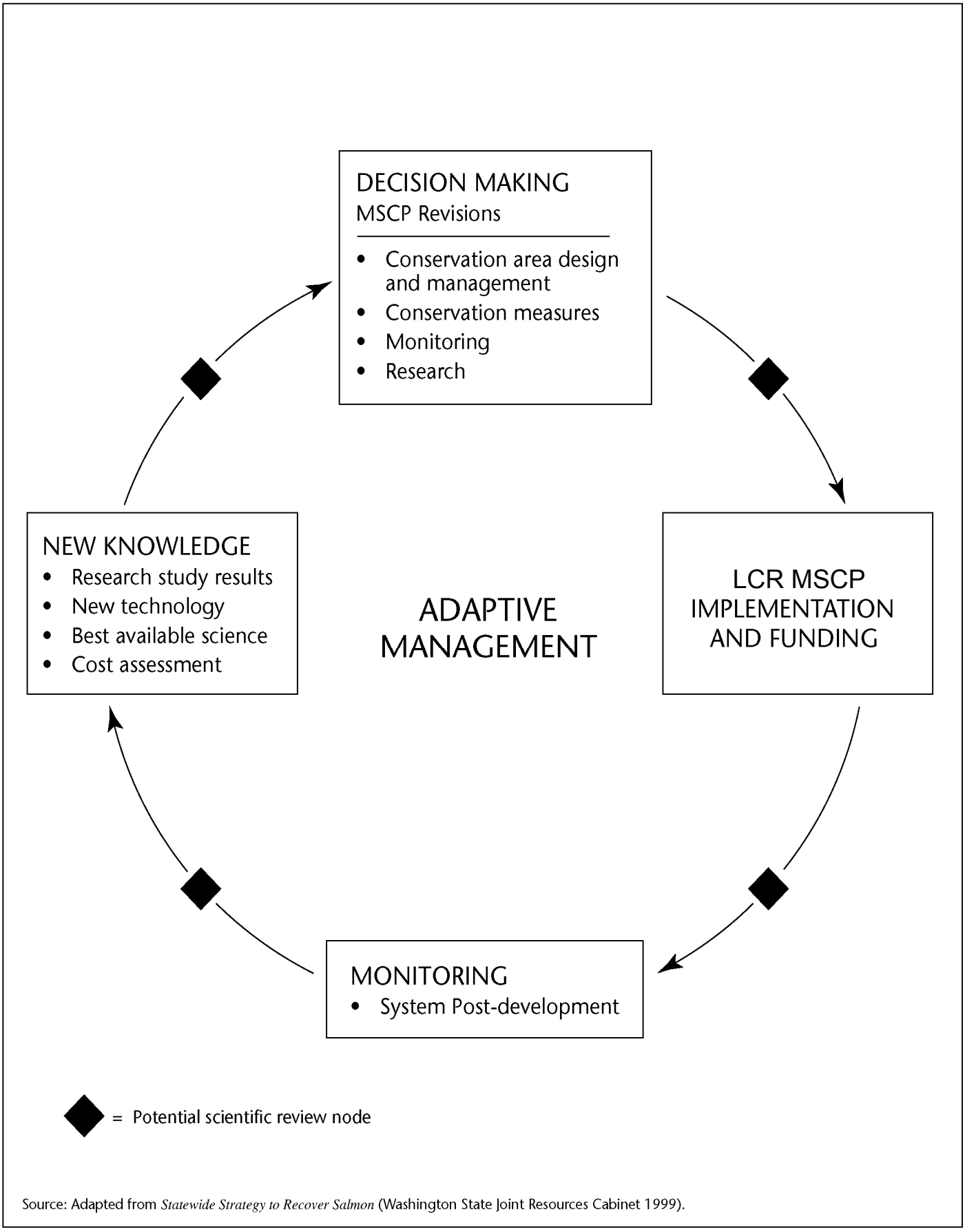
The cornerstone of the adaptive management process is the LCR MSCP monitoring and research program (Section 5.11). Information collected through monitoring and research will be used to design and manage created habitat and provide information to direct the fish augmentation element of the LCR MSCP. During the early phases of LCR MSCP implementation, monitoring and research will provide data to improve the efficacy of techniques to successfully create habitat. As habitats are created, the adaptive management process will allow for the experience gained through early projects to shape and refine future habitat creation projects.

The data collected, evaluated, and managed through the monitoring and research program will provide a scientific basis for modification of existing projects or development of alternative measures that will provide greater benefits or more efficient use of LCR MSCP resources. Such modified/alternative measures will be developed as written proposals and will be presented to the LCR MSCP Steering Committee by the Program Manager, together with an estimate of the costs. These proposals will be evaluated to ensure that they are consistent with the LCR MSCP goals and can be accomplished within the limits of the budget and financing assurances of the Applicants (see Chapter 7).

Action plans and budgets, reflecting the implementation of conservation projects, will be presented to the USFWS for its review and written concurrence that they conform to the terms and conditions necessary or appropriate for purposes of the incidental take authorization. Modified/alternative conservation measures and methods that have been generated through the adaptive management process, proposed by the Program Manager, reviewed by the LCR MSCP Steering Committee, and with USFWS concurrence will not require an amendment to the section 10 permit or reinitiation of section 7 consultation.

5.12.2 Adaptive Management Activities

Under the LCR MSCP, adaptive management focuses on two primary types of conservation measures—(1) the creation, function, and management of covered species habitats and (2) the effectiveness of fish augmentation strategies. This section generally describes the types of adaptive management–related activities that will be undertaken



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Source: Adapted from *Statewide Strategy to Recover Salmon* (Washington State Joint Resources Cabinet 1999).

Figure 5-4
Adaptive Management Process

early (e.g., the first 5 years) in LCR MSCP implementation. Detailed descriptions of adaptive management–related activities (e.g., pilot projects, study designs, research proposals) will be included in annual action plans and budgets developed by the Program Manager and submitted to the Steering Committee and USFWS for review.

5.12.2.1 Created Habitats

To address uncertainties surrounding species requirements, habitat creation techniques, and the capabilities of potential habitat creation sites to support habitat, the LCR MSCP anticipates that the first few years of LCR MSCP implementation will focus on conducting research and adaptive management experiments (e.g., pilot habitat creation projects to test habitat creation techniques) to collect information necessary to ensure successful creation of covered species habitats. As created habitats become established, it is anticipated that results of post-development monitoring conducted to determine the response of covered species to the conservation measures will be used to make subsequent adaptive management decisions.

Research studies to address key uncertainties that are anticipated to be conducted in the first 5 years of implementation include, but are not limited to, studies to:

- determine the microhabitat requirements for MacNeill's sootywing skipper to provide information necessary to select appropriate habitat creation sites and develop appropriate habitat creation designs and techniques;
- better define the elements of Colorado River cotton rat and Yuma hispid cotton rat habitat to provide information necessary to select appropriate habitat creation sites and develop appropriate habitat creation designs and techniques;
- identify appropriate habitat creation techniques (e.g., seed collection, soil conditioning, irrigation methods);
- identify appropriate methods for ensuring successful production of flying insects in created southwestern willow flycatcher habitat;
- identify appropriate habitat designs and management techniques to co-manage created habitat for both the southwestern willow flycatcher and yellow-billed cuckoo; and
- identify the effects of brown-headed cowbird nest parasitism and European starling nest site competition on the reproductive success of covered species.

Each habitat creation project will be designed in a manner to test habitat establishment techniques and identify appropriate habitat management techniques (e.g., appropriate irrigation schedules and weed control methods). For example, projects to establish native vegetation (e.g., cottonwood-willow) to provide habitat in existing saltcedar-dominated communities would be designed as pilot or demonstration projects to test establishment techniques (e.g., successful removal of saltcedar, subsequent control of saltcedar, irrigation requirements). Information learned from these initial habitat creation projects would be used to refine habitat creation site selection criteria and habitat established and management techniques that would be applied to subsequent projects.

Once created habitats have developed, results of post-development monitoring surveys to determine the use of created habitats by covered species would be used to assess the need to adjust the design of subsequent habitat creation projects, adjust management of the created habitat, or modify or adopt new conservation measures to address species needs. For example, if created habitats are not used by applicable covered species in future years, then:

- Additional research would be conducted to determine whether the created habitat provides for all of the species' needs and, if not, then:
  - the designs of subsequent created species habitat would be adjusted to ensure all of the species' habitat requirements are provided and
  - to the extent practicable, management of the created habitat would be adjusted to improve habitat for the species.
- If created habitat is not used and its lack of use is not related to habitat design or management (e.g., habitat is not limiting the population), funding may be reallocated, if appropriate, to implement new conservation measures that are more likely to benefit the species.

5.12.2.2 Fish Augmentation Strategies

The LCR MSCP will implement an adaptive management process to reevaluate the augmentation strategy for bonytail and razorback sucker, based on the results of monitoring and research. Monitoring and focused research will be components of the adaptive management process. For example, the stocking of 8,000 subadult bonytail and 24,000 subadult razorback suckers for 5 consecutive years below Parker Dam (conservation measures BONY3 and RASU3) will be conducted as adaptive management experiments, elements of which will include focusing augmentations in locations that currently support the species, followed by intensive monitoring and research for an estimated 7–8 years. Release of fish into the LCR will target a mix of riverine and lacustrine habitat types. Augmented bonytail and razorback sucker released will be marked with an appropriate batch-marking methodology and a statistically valid subset of released fish may also be PIT tagged or identified with other appropriate technology providing a similar level of individual fish identification. Monitoring will focus on determining key environmental correlates affecting survival, growth, movement, and reproduction (e.g., key habitat [e.g., depth, velocity, channel form, cover, substrate], continuity, water temperature, food, and predation).

Following the 7–8-year intensive monitoring and research period, the information and insights gained will focus expenditure of the remaining funds on those management activities potentially contributing the most to achieving the recovery goals for bonytail and razorback sucker. As appropriate, the management activities may include changes to the Applicants' proposed augmentation approach, rates, and targeted areas. The monitoring and research information will also guide maintenance, enhancement, and creation of bonytail and razorback sucker habitat (e.g., backwaters).

5.12.3 Changed Circumstances and Remedial Measures

The regulations governing section 10 incidental take permits provide for inclusion of remedial measures to address changed circumstances in an HCP. Remedial measures will be implemented, as necessary, to respond to changed circumstances. Changed circumstances are defined as "changes in circumstances affecting a species or geographic area covered by a conservation plan that can reasonably be anticipated by plan developers and the USFWS and that can be planned for..." (50 C.F.R. §17.3). Changed circumstances for which the Program Manager will implement remedial measures should they occur are identified in Table 5-13.

Table 5-13. Changed Circumstances and Remedial Measures

Changed Circumstances	Remedial Measures
The creation of land cover as habitat for one or more covered species in accordance with the LCR MSCP Conservation Plan is unsuccessful, i.e., fails to provide essential habitat elements for one or more of the covered species whose habitat is expected to be provided by the land cover type.	The cause of failure will be identified through the monitoring and research that is part of the adaptive management process included in the LCR MSCP. The adaptive management process will be used to identify and develop measures to correct or replace the failed conservation measure or to implement an alternative conservation measure.
Insufficient water is available, regardless of cause (e.g., drought conditions, reduction in water allocations), to maintain established created land cover types as habitat for one or more covered species.	The Program Manager will coordinate with the USFWS to prioritize the distribution of available water among created habitats to ensure that the greatest benefits for covered species will be provided by the amount of water available for maintenance of created habitats.
Created backwater and marsh land cover that provide habitat for covered species in conservation areas are lost because of sedimentation resulting from floods.	Dredging will be implemented to restore patches of backwater and marsh land cover created as covered species habitat.
Created cottonwood-willow and honey mesquite land cover that provide habitat for covered species in conservation areas are lost as a result of floods.	Created habitats will be reestablished following loss to flooding. In the event of such loss, land management and created habitat restoration measures will be implemented in conservation areas to ensure the reestablishment of native vegetation through active management or natural processes.
Fish in rearing facilities or in the stocking process are lost, causing disruption of fish augmentation conservation measures.	Stocking will be increased in subsequent years and/or the time period will be extended within the permit term for fish augmentation to meet the total augmentation goals.
Rearing facilities or aquaculture techniques fail to provide sufficient numbers or sizes of fish to meet fish augmentation goals.	Other management activities will be identified, through monitoring and research, to provide benefits to the fish species.
A toxic or hazardous substance spill occurs, affecting LCR MSCP conservation areas.	In the event of such loss, land management and created-habitat restoration measures will be implemented in conservation areas to ensure the restoration of the conservation area through active management or natural processes.
Future listing of a non-listed covered species.	The USFWS will automatically authorize take of such newly listed covered species as prescribed by regulation (63 FR 35, February 23, 1998).

To address the potential for changed circumstances, the Applicants have allocated contingency funding above the cost of implementing the LCR MSCP conservation measures. This contingency funding provides the financial means to implement remedial measures in the event that changed circumstances occur. In the event that changed circumstances occur, the Program Manager will implement the remedial measures identified in Table 5-13, but no additional conservation or mitigation measures can be required without the Applicants' consent (50 C.F.R. §17.22[b][5]). Remedial measures will be implemented within the available LCR MSCP budget, including contingency funding committed by the LCR MSCP participants for changed circumstances.

The Program Manager will notify the USFWS within seven days after learning of the occurrence of a changed circumstance identified in Table 5-13. As soon as practicable, but no later than 30 days after learning of the changed circumstance, the Program Manager will develop an approach to implement the applicable remedial measures described in Table 5-13 to the extent necessary to correct the effects of the changed circumstance on covered species, and notify the USFWS of their implementation.

If the USFWS determines that changed circumstances have occurred and that the Program Manager and the Permittees have not responded in accordance with the appropriate existing LCR MSCP agreements, USFWS will so notify the Program Manager and the Permittees and will direct them to make the required changes. Within 30 days after receiving such notice, the Program Manager and the Permittees will make the required changes and report to the USFWS on their activities. Such changes are provided for in the LCR MSCP, and hence do not constitute unforeseen circumstances or require amendment of the Permit or the LCR MSCP.

5.12.4 Unforeseen Circumstances

Unforeseen circumstances are defined as (17 C.F.R. §17.3):

> changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the USFWS at the time of the conservation plan's negotiation and development, and that result in a substantial and adverse change in the status of the covered species."

In the event of unforeseen circumstances during the life of the LCR MSCP's incidental take permit, amendments to the HCP may be proposed by either the Applicants or USFWS to address these circumstances. The USFWS and Applicants would work together to identify opportunities to redirect resources to address unforeseen circumstances. Notwithstanding the foregoing, however, USFWS will not:

- require the commitment of additional land, water, or financial compensation by the Applicants other than those agreed to elsewhere in the HCP or
- impose additional restrictions on the use of land, water, or natural resources otherwise available for use by the Applicants under the original terms of the LCR MSCP HCP to mitigate the effects of the covered activities.

5.12.5 Recovery Plans

It is expected that additional recovery plans could be developed for Federally listed species or LCR MSCP species that become listed over the 50-year life of the LCR MSCP. The LCR MSCP adaptive management process allows for revisions of objectives and conservation measures to incorporate recovery strategies identified in new or revised recovery plans. The Program Manager will incorporate conservation measures identified in future or revised recovery plans when such measures:

- are expected to improve the effectiveness of the LCR MSCP in achieving covered species goals,
- can be achieved in the LCR MSCP planning area, and
- are compatible with the LCR MSCP covered species goals, conservation area framework and management, and LCR MSCP funding levels.